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Nuclear Science Abstracts

Vol. 2 No. 11
June 15, 1949

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Technical Information Branch, Oak Ridge, Tennessee
AEC, Oak Ridge, Tenn., 6-15-49--1800-A6838

Printed in U.S.A.
PRICE 25 CENTS

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NUCLEAR SCIENCE ABSTRACTS

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ABSORPTION AND SCATTERING OF RADIATION

2067 Alpha-Particles from Fission as Recorded by Photographic Emulsions by L Marshall Phys Rev 75 1339-1344 (1949) May 1

This article is based on AECD-2382. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-1752.

2068 Angular Distribution of 1- to 3.5-Mev Protons Scattered by He^4 by George Freier, Eugene Lampi, W Sleator and J H Williams [Phys Rev 75 1345-1347 (1949) May 1]

The angular distribution of protons scattered by He^4 has been measured in the energy range from 1 to 3.5 Mev and over an angular range of 10° to 164° in the laboratory. The results are given as absolute cross sections per unit solid angle and show a broad resonance at approximately 2.2 Mev. The values for the cross sections are considered to be reliable to ± 3 per cent.

2069 Ionization and Charge Exchange by Fast Ions of Hydrogen and Helium by J P Keene Phil Mag 40 369-385 (1949) Apr

An account is given of experiments involving collisions of H^+, H_2^+, and He^+ ions with hydrogen and helium in the energy range 3-35 Kev. The construction of apparatus for producing suitable beams of ions is described and details presented of an accurate method for measuring charge exchange and ionization cross-sections. Curves showing the values of these cross-sections are given and they are compared with the results of other workers where these are available. A method for measuring e/m values of secondary ions is also described. 18 fig. 16 ref.

2070 On the Problem of Nucleon Scattering (Zum Streuproblem von Nukleonen) by P Urban and F Schwarzl Acta Phys Aust 2 368-378 (1949) Feb (In German)

On the basis of Yukawa's scalar theory, a calculation is made of effective cross sections of processes in which protons (neutrons), whose initial energy is large in comparison with their rest energy, are scattered by a proton (neutron) with the formation of a meson. This problem has already been treated by Nordheim and Nordheim [Phys Rev 54 254 (1938)]; however, in the formula used by these authors (formula 19 a of their paper) the resonance denominator of the interaction term was erroneous. Wang [Z Physik 115 431 (1940)] has made similar calculations by using the Weizsäcker-Williams' method. The present authors made the quantum-theoretical perturbation computation, using the correct resonance denominator. They obtained an expression for the integral effective cross section that is, in its main term, close to that found by the Nordheims; however, its additional terms modify the effective cross section notably, at least in cases of relatively small initial energies of the impinging protons. As to Wang's results, their rather strong disagreement with that of the present authors is due to the approximate character of the half-classical Weizsäcker-Williams' method.

2071 Proton Resonances in the Deuteron Bombardment of Carbon by N P Heydenburg, D R Inglis, W D Whitehead Jr and E M Hafner Phys Rev 75 1147-54 (1949) Apr 15

The protons resulting from the deuteron bombardment of C^{12} have been studied in some detail, with particular emphasis on the variation of the intensity of the long-range protons with energy and angle. Excitation curves at three fixed angles, one forward, one backward, and one at 90° to the beam, show peaks which in some cases agree in energy with one another and with neutron and gamma-peaks observed in the same bombardment elsewhere. In other cases, however, there is no peak on one mode of observation at an energy where one appears in another. In some cases peaks in different modes of observation which do not quite coincide in energy are so close together that it seems reasonable to attribute them to the same virtual level of the compound nucleus, and the existence of the small energy discrepancies is discussed. Two shorter range groups of protons have been studied less extensively because they penetrate the thin windows only at high bombarding energies, and their range coincides with that of the scattered deuterons at some bombarding energies. The two short-range groups indicate excited states of C^{13} at 3.12 and 3.91 Mev. A possible low excited state near 0.8 Mev, suspected from an α-induced reaction, was not confirmed. The transition to it cannot be shown to be absent but only weak because protons indicating its existence could be masked by protons observed from an oxygen

ABSORPTION AND SCATTERING OF RADIATION (continued)

impurity. Of the three angular distributions observed in detail, the one at the lowest bombarding energy is the simplest, in keeping with the expectation that only deuterons of low angular momentum penetrate at low energies.

2072 Stopping Power of Liquid Water for α-Particles by R K Appleyard Nature 163 526 (1949) Apr 2 (Letter to editor)

Experiments have been undertaken in order to redetermine the stopping power of water for α-particles, since the previous data [Michl, Sitzber Akad Wiss Wein 123 II A 1965 (1914); Philipp, Z Physik 17 23 (1923)] are considerably higher than the predicted values from the Bragg law and the accepted atomic stopping powers of hydrogen and oxygen. The source of α-particles used was an aqueous solution of polonium in 0.5-1.5 N hydrochloric acid and a thin window Geiger counter served as a detector. Preliminary results indicate that for 4-5 Mev α-particles the instantaneous stopping power (per molecule of liquid water) relative to that of air (per atom) is 1.71. The experimental error of the determination is estimated to be less than $\pm 5\%$. A value of 1.51 is predicted by the Bragg law. The value obtained agrees with the mean stopping powers obtained by Michl and Philipp. In the assessment of the radiotherapeutic effects of heavy particles, it is suggested that the higher value of the stopping power of water should be used.

ASTROPHYSICS

2073 Cosmogony (Kosmogonie) by C F von Weizsacker FIAT Review of German Science 1939-1946. Astronomy, Astrophysics and Cosmogony. Wiesbaden, Germany, Office of Military Government for Germany Field Information Agencies Technical 413-426 (1948) (In German)

This article, which is a survey of the contributions of German authors in the field of cosmogony during the period 1937-1946, contains data on the probable age of earth, of cosmic objects and of the universe. Meyer [Wiener Ber 146 175 (1937); Naturwissenschaften 25 764 (1937)] compared the existing quantities of uranium isotopes with those of their end products, the lead isotopes; the value obtained, giving the age of the earth's crust, is 4.6×10^9 years. Wefelmeier (manuscript interrupted by author's death) used the comparative abundance of U^{235} and U^{238}, their disintegration constants, and the empirical rules of the general isotope statistics for the computation of the probable age of the universe; he found $(4.5 \pm 2.5)10^9$ years. Nier [Phys Rev 55 150 (1939)] obtained the value 2.2×10^9 years for the age of the oldest known uranium minerals, on the basis of the abundance ratio of Pb^{206} and Pb^{207}. Koczy [Nature 151 24 (1943)], by assuming that the totality of Pb^{206} and Pb^{207} originated from U, found as the upper limit 5.5 x 10 years. This assumption was avoided by Houtermans [Naturwissenschaften 18 185 (1946)] and Holmes [Nature 157 680 (1946)] who used the variations in the isotope content in ordinary lead minerals of different geologic ages for the determination of the initial point in the process of contamination of the "natural" lead by radiogenic lead; the result obtained by them (age of the earth crust) is 2.9×10^9 years. The agreement between all these data is surprisingly good. The application of the U:He method to the meteroites [Paneth, Nature (1942)] gave 5×10^9 to 7×10^9 years. If it is assumed that U, Th, K^{40}, Rb^{87}, and Sm are not generated in the present universe, their present content shows that the universe cannot be much older than the half-life periods of these elements. Among the purely astronomical methods, that connected with the theory of the expansion of the universe was analyzed by Heckmann [Theorien der Kosmologie, Berlin (1942)]; he found as the most probable age of the universe 1.75×10^9 years. All recent determinations of the age of individual cosmic objects also result in values of a few 10^9 years; the methods used are based on theories of the structure and the movements of these objects. The older views, which led to higher values (from the consideration fo dynamical properties of star systems), are being found less convincing in the light of more recent theories.

ASTROPHYSICS (continued)

2074 Remarks on the Evolution of the Expanding Universe by Ralph A Alpher and Robert C Herman Phys Rev 75 1089-1095 (1949) Apr 1

The relativistic energy equation for an expanding universe of non-interconverting matter and radiation is integrated. The result obtained, together with a knowledge of the physical conditions that prevailed during the element forming process in the early stages of the expansion, is used to determine the time dependences of proper distance as well as of the densities of matter and radiation. These relationships are employed to determine the mean galactic diameter and mass when formed as 2.1×10^3 light years and 3.8×10^7 sun masses, respectively. Galactic separations are computed to be of the order of 10^6 light years at the present time.

ATOMIC ENERGY AND NUCLEAR REACTORS

2075 Atomic Energy - Its Release, Utilization, and Control by R A Millikan Proc Inst Radio Engrs 37 545-547 (1949) May

The historical development of some of the important concepts of nuclear physics is traced and a few of these concepts are discussed, in a simplified form, in relationship to the development of the atomic bomb. The necessity for conservation of the limited uranium supplies available is noted.

BIOLOGICAL EFFECTS OF RADIATION

2076 Direct and Transmitted X-Ray Effects on Growth of Tobacco Callus in Vitro by Gladys S King Amer J Botany 36 265-270 (1949) Mar

A study of the effects of X-rays on tobacco callus throughout a dosage range having a maximum value of 120,000 r has indicated the suitability of this material for radio-biological investigations. Curves and tabular data are given on the size as a function of time for both irradiated tissue and non-irradiated controls for a period of 10 days following radiation. The effects produced on non-irradiated tissue by proximity to irradiated tissue are included. It was found that a 4,000 r dose stimulated growth, whereas a 10,000 r dose had an inhibitory effect which became more pronounced when the dose was increased to 20,000 r. In general these effects of radiation upon the growth became evident 3-7 days following irradiation. However, when the dosage was increased to 60,000 r, the marked inhibition produced extended throughout the entire growth period and the cultures were characterized by a broken growing tissue zone. The maximum dose, 120,000 r, resulted in the complete arrest of cell formation and fragments given this dosage were characterized by extensive surfact cutinization. Since irradiated fragments, when cultured adjacent to non-irradiated fragments, produced growth inhibition in the latter, the author concludes that the irradiation produced a diffusible substance. It is suggested that the postulated substance thus formed produced the inhibition and induced meristem formation in the non-irradiated cultures, and that the latter effect might be due to the reduction of the auxin content. 3 tables. 19 ref.

2077 The Effect of X-Rays on the Mitotic Activity of the Adrenal Gland, Jejunum, Lymph Node and Epidermis of the Mouse by Norman P Knowlton Jr and Louis H Hempelmann J Cellular and Comp Physiol 33 73-91 (1949) Apr

The effects of 250 KV X-rays on mitotic activity of the adrenal gland, lymph node, jejunum, and epidermis of the mouse have been investigated. The data obtained are summarized in 7 curves and 4 tables. In general a quantitive response to irradiation was observed although there is a lack of correlation between the sensitivity of the mitotic activity to ionizing radiation and the radio-sensitivity of different tissues. The mitotic activity of most radio-sensitive tissues apparently responds less to irradiation than that of tissues showing a lower degree of histologic response to the radiations. In several tissues "overcompensation" was observed in the response of the mitotic index to irradiation; the possible mechanism for this is discussed. An attempt has been made to explain the abortive rise in the mitotic indices of the adrenal gland and the jejunum by the use of the direct and indirect concept of radiation injury previously reported by Hance [J Morphology 66 409-422 (1940)]. The possibility of using the depression in mitotic activity subsequent to irradiation as a measure of the biological effects of radiations of different types is suggested. 7 fig. 20 ref.

BIOLOGICAL EFFECTS OF RADIATION (continued)

2078 The Influence of Thyroid and Thiouracil on Mice Exposed to Roentgen Radiation by Henry C Blount, Jr and Willie W Smith Science 109 83-84 (1949) Jan 28

Experiments to determine the effects of thyroid and thiouracil feeding, and heat on mice exposed to damaging roentgen radiations are summarized. Radiation doses delivered with an effective voltage of 170 kv, 20 ma, through aluminum and copper filters, were administered. Mice on thyroid and thiouracil diets for 13 and 8 days before radiation were examined up to 4 weeks later. Mortality rates and temperature experiments indicate that metabolic activity rather than body temperature is the predominant factor in increasing the mortality of mice exposed to the rays. Further experiments are in progress.

2079 Studies on the Mechanism of Action of Ionizing Radiations I. Inhibition of Enzymes by X-Rays by E S Guzman Barron, Sherman Dickman, John A Muntz and Thomas P Singer J Gen Physiol 32 537-551 (1949) Mar 20

Dilute solutions of sulfhydryl enzymes (phosphoglyceraldehyde dehydrogenase, adenosinetriphosphatase, succinoxidase) showed reduced activity on irradiation by small amounts of X-rays. When the inhibition was partial the enzyme was reactivated on addition of glutathione. When the inhibition was more complete, reactivation was only partial. These observations are interpreted as being due to oxidation of the —SH groups of the protein by the products of water irradiation, the radicals OH and O_2H, and H_2O_2 and atomic oxygen. The mechanism of the oxidation is best explained by Weiss's theory [Nature 153 748 (1944); 157 584 (1946)]. The irreversible inhibition which occurs when the dose of X-rays is increased is attributed to protein denaturation. Inhibition of the non-sulfhydryl enzymes trypsin, catalase, and ribonuclease, which required larger amounts of X-rays, is attributed to protein denaturation. These experiments are further evidence that inhibition of enzymes by ionizing radiations is due to the indirect action of the products of irradiated water rather than to direct ionization of the enzyme through collision with ionizing radiation. 15 tables. 31 ref.

BIOLOGY, GENERAL

2080 The Failure of Non-Isotopic Uranium to Inhibit Resorptive Processes in Rat Femur by W F Neuman, M W Neuman and B J Mulryan. AECD-2580 Mar 21 1949 Decl May 2 1949 8p For publication in NNES

In an earlier study [Neuman, M W and Neuman, W F, J Biol Chem 175 711 (1948)] a radioactive uranium nitrate preparation administered intraperitoneally to rats resulted in an inhibition of the resorptive processes of the skeleton. A repetition of the experiment employing non-isotopic uranium gave no interference with the resorptive processes of bone. It was concluded that the inhibition of these resorptive processes reported earlier was caused by radiation and not by any specific chemical property of uranium itself.

2081 A Radioautographic Study of the Localization of Radioactive Europium in the Soft Tissue of the Rat by C D Van Cleave. AECU-218 nd 1p

This document is in abstract form; it is reproduced below in its entirety.

Radioautographs of liver, kidney and spleen were investigated following the intravenous and intramuscular administration of radioactive europium (Eu^{154}). Following intravenous administration radioactive europium apparently was deposited primarily in the reticulo-endothelial system of the liver and spleen. The uptake following intramuscular administration was not sufficiently high to permit any detailed evaluation of the areas of localization of this radioactive substance.

2082 Analysis of Microcomposition of Biological Tissue by Means of Induced Radioactivity by Cornelius A Tobias and Rayburn W Dunn Science 109 109-113 (1949) Feb 4

This article is based on AECD-2099-B. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-419-B.

BIOLOGY, GENERAL (continued)

2083 Effects of Plutonium in the Liver by Austin M Brues Conf on Liver Injury, Trans 7th Conf 59-61 (1948)

It has been determined that the early distribution of plutonium is in the liver and spleen and that it is gradually translocated to the bone. The effect of injecting a large dose (1γ per g in the rat) was, as in total body radiation, to produce death. However, rats and mice given a smaller dose may survive for several months, although they show clinical evidence of liver disease, and severe cell damage and atrophy of the liver. Although liver carcinomas did not develop, bone carcinomas frequently occurred nearly a year later. Hypertrophy of liver tissue around the margin of atrophic nodules has been attributed to the tendency of cerium-144 to concentrate in the liver.

2084 Studies with Colloids Containing Radioisotopes of Yttrium, Zirconium, Columbium, and Lanthanum II The Controlled Selective Localization of Radioisotopes of Yttrium, Zirconium, and Columbium in the Bone Marrow, Liver, and Spleen by Ernest L Dobson, John W Gofman, Hardin B Jones, Lola S Kelly and Leonard A Walker J Lab and Clin Med 34 305-312 (1949) Mar

This article is based on AECD-2055. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-43.

CHEMISTRY, ANALYTICAL

2085 The Spectrochemical Analysis of Hafnium and Zirconium by John G Conway and Milton F Moore. AECD-2582 Mar 16 1949 Decl May 13 1949 10p

The analysis of hafnium and zirconium by the copper spark technique is presented for solutions of HCl, HF and $HClO_4$ acids. The special techniques of electrode protection and vacuum drying of perchloric acid samples are outlined. Also given are the working curves and deviations of both elements.

2086 The Separation of Purine and Pyrimidine Bases and of Nucleotides by Ion-Exchange by Waldo E Cohn. AECU-208 May 2 1949 11p

The techniques for the separation of the purine and pyrimidine bases, nucleosides, and nucleotides by ion-exchange chromatography are outlined. With anion-exchangers and in alkaline solution all five bases (adenine, quanine, cytosine, thymine and uracil) may be separated with recoveries of 97.5-99%. At pH 4 and with cation-exchangers cytosine, quanine, and adenine may be separated with recoveries of 98.5-101.5%. The mononucleatides of ribosenucleic acid (uridylic, cytidylic, granylic, and adenylic acids) are separated in a cation-exchange column with recoveries of 75-100%.

2087 Electroseparation of Technetium from Rhenium and Molybedenum by L B Rogers J Amer Chem Soc 71 1507-1508 (1949) Apr

Technetium (Tc^{99} - 9 x 10^5 years) can be electrolytically separated from rhenium and molybdenum in a 2 M NaOH solution, at -1.1 v vs. the saturated calomel electrode. The ions TcO_4^- are reduced to a lower oxide forming a precipitate on a platinum cathode. Counting showed yields exceeding 95%. The spectrographic analysis of the precipitate (dissolved in a mixture of NH_3 and H_2O_2, evaporated and redissolved in 2 M NaOH) showed that the separation of Tc from Mb and Re was very satisfactory.

2088 Streaming Potential in Paper Chromatography by L Rutter Nature 163 487 (1949) Mar 26 (Letter to the editor)

It has been verified experimentally for some cases that, as has been previously suggested [Kruyt, Kolloid-Zeitschrift 22 81 (1918)], a streaming potential is set up due to the net resultant flow of solvent through the capillary channels of paper used in chromatography in a direction away from the point of feed. Distilled water flowing through a washed and dried strip of No. 3 Whatman paper showed a potential gradient of approximately 10 mV. per cm measured by a Cambridge ph meter. With 1% thorium nitrate solution in place of water, the potential was reduced almost to zero. One percent sodium chloride solution showed a potential gradient of approximately 4 mV. per cm. Such potentials may well exert a marked effect on the process of chromatographic development and preliminary experiments in which the potentials have varied have given interesting indications.

CHEMISTRY, GENERAL

2089 Separation of Hafnium and Zirconium by a Fractional Distillational Procedure by D M Gruen and J J Katz. AECD-2584 Mar 29 1949 Decl May 10 1949 4p Proposed for publication in J Amer Chem Soc

A method first reported by Van Arkel and De Boer [Z Anorg Chem 141 289-296 (1924)] was investigated in some detail. It involves fractional distillation at atmospheric pressure of the volatile complex compounds formed by the reaction of Zr or Hf tetrachlorides with $POCl_3$. An Oldershaw perforated plate column with 50 plates was used for the distillation. The overall separation factor of the Zr and Hf complexes was 9.

2090 The Synthesis of 1, 2-Cycloheptanedionedioxime by Roy W Vander Haar, Roger C Vote and Charles V Banks AECU-215 nd 7p

A method has been devised for the preparation of 1,2-cycloheptanedionedioxime in amounts large enough to be useful in inorganic analytical application. The scheme involves oxidation of cycloheptanone to 1,2-cycloheptanedione with selenium dioxide, and conversion of the diketone to the dioxime with hydroxylamine. An overall yield of 40% is obtained.

2091 Synthesis of dl-Phenylalanine-β-C^{14} by James C Reid. AECU-216 Mar 1 1949 9p

The synthesis of dl-phenylalanine-β-C^{14} is described. Carboxy-labeled benzoic acid is reduced to benzylalcohol with lithium aluminum hydride, which after chlorination with $SOCl_2$, is condensed with acetylaminomalonic ester and the product is hydrolyzed and decarboxylated. The overall yield based on benzoic acid is 40%. Several alternate methods for this preparation are also discussed.

2092 Chemical Investigations Related to Nuclear Fission (Chemische Untersuchungen zur Kernspaltung) by W Seelmann-Eggebert and H Götte FIAT Review of German Science 1939-1946 Inorganic Chemistry Part 1 91-112 (1948) (In German)

This is a review of the work done in Germany on chemical methods of separation of the products of nuclear fissions (62 references). Among others, numerous papers of Hahn and Strassmann are mentioned. A table gives information on all isotopes derived from uranium (and thorium) fission which have been so far identified in Germany. A condensed description of analytical procedures is based on the material contained in the following works: Hahn, Strassmann, and Seelmann-Eggebert, Z Naturforsch 1 545 (1946); Hahn and Strassmann, Z Naturforsch in print; Seelmann-Eggebert, Z Naturforsch in print. The description gives 1) successive stages of a methodical chemical separation of uranium-fission products, and 2) methods of rapid isolation of individual uranium-fission elements. A few points may be mentioned: Lindner [Z Physik Chem 194 A 51 (1944); Lindner and Peter, Z Naturforsch 1 372 (1946)] uses a chromatographic method for the enrichment and isolation of rare earths: chlorides or nitrates of various pH are adsorbed on aluminum hydroxide. Starke [Naturwissenschaften 30 577 (1942)] and Götte use 1.3-diketones (benzoyl-acetone, dibenzoylmethane) to form stable complex uranyl salts, soluble in organic substances only: a rapid separation of rare earths and of neptunium, and an enrichment of U^{239}, can be obtained by these methods. Only a mention is made of Erbacher's method of electrochemical separation; it is described elsewhere in this review [FIAT Review of German Science 1939-1946 Inorganic Chemistry Part 1 113 (1948)].

2093 1-C^{14}-D-Glucose and 1-C^{14}-D-Mannose by John C Sowden Science 109 (1949) Mar 4

The preparation in the crystalline state of d-glucose and d-mannose, labeled in the aldehyde carbon, by the application of the nitromethane synthesis [J Amer Chem Soc 66 1312 (1944); 67 1713 (1945); 68 1511 (1946); 69 1048, 1963 (1947)], to d-arabinose is described. This synthesis was necessary to supply the need for a glucose containing C^{14} in only one known position of the carbon chain to use in studying the fate of hexose in experiments involving fragmentation of the molecule. Details of the synthesis through the C^{14} methanol, methyl iodide, nitromethane, and 1-nitro-1-desoxy-d-mannitol stages to d-glucose and d-mannose are given with references to previous workers. 10 references

CHEMISTRY, GENERAL (continued)

2094 2-Acetylamino-9-C^{14}-Fluorene by Francis Earl Ray and C Robert Geiser Science 109 200 (1949) Feb 25

Radioactive carbon-14 was used in the synthesis of 2-acetylaminofluorene for the purpose of determining the complete mode of action of the compound in producing cancer in rats. The C^{14} was placed in the 9-position of the molecule. The synthesis is described in detail, showing yields through the various steps from the starting materials, 2 mc of $BaC^{14}O_3$ and 11.5 g of 2-iodobiphenyl. The metabolism of this compound is now being studied.

COSMIC RADIATION AND MESONS

2095 Charge-Exchange Reaction of the μ-Meson with the Nucleus by J Tiomno and John A Wheeler Revs Modern Physics 21 153-165 (1949) Jan

The reaction of negatively charged μ-mesons with atomic nuclei on the hypothesis that the elemetnary process involved is the transition μ-(meson) + P(proton $\rightarrow \mu_0$(neutral meson) + N(neutron) is investigated. The coupling constant required to make the rate of reaction agree with observations is determined approximately and is found to be of the same order of magnitude as that required (a) to account for β-decay and (b) to account for the disintegration of μ-mesons on the three-particle hypothesis along the lines discussed in a preceding paper. [Revs Modern Physics 21 144 (1949)]. The theoretical probability distribution of excitation of a nucleus which has reacted with a μ-mesons is calculated approximately and correlated with the observations of Chang [Revs Modern Physics 21 166 (1949)]. In the treatment the following are discussed: 1) the individual particle model, 2) the free particle model, 3) the dipole transition model, and 4) the free particle treatment for oxygen without limitations on wave-length of the neutral meson.

2096 A Cloud-Chamber Study of Meson Absorption by Thin Pb, Fe, and Al Foils by W Y Chang Revs Modern Physics 21 166-180 (1949) Jan

Cloud-chamber experiments are described on the absorption of slow mesons by thin Al (0.002 and 0.032 inch), Fe (0.028 inch), and Pb (0.018 inch) foils, which (a) set an upper limit on the probability of meson-induced emission of protons and (b) give evidence for the emission of 1-5 Mev γ-radiation when a meson is caught in Pb. Variation of the ionization from foil to foil is used as the technique to identify protons, mesons, and electrons near the end of their range. Cloud-chamber pictures of these three types of particles are given for illustration. From the data, it is concluded that no protons are emitted when a negative μ-meson interacts with a Pb nucleus. These experiments are consistent with a similar absence of meson-induced protons from the nuclei of Fe and Al (potential barriers about 5 Mev and 3 Mev, respectively). However, statistics for these two elements are insufficient to prove that no protons ever emerge from these substances. The results obtained in Pb argue that the meson imparts only a small part of its rest energy to the nucleus and that the remainder—to escape cloud-chamber observation—must be given off as a neutral, non-electromagnetic radiation. It is also concluded that mesons which do not decay disappear by a charge-exchange reaction in which the negative meson loses its charge, becoming neutral, and that of the original nucleus becomse a unit smaller. A much smaller portion of the rest energy may come off in the form of γ-rays. These meson-associated photons arise (1) outside the nucleus, due to meson jumps between Bohr orbits, and (2) within the nucleus, following reaction of the negative μ-meson with the nucleus. The energy and frequency of occurrence (much higher than chance) of these electrons are compatible with those predicted in Wheeler's theory of meson transition between Bohr orbits and with those expected from nuclear excitation as a result of negative μ-meson capture followed by neutral meson (or neutrino) emission.

COSMIC RADIATION AND MESONS (continued)

2097 Electron Emitting Power of Stopped Mesons by Thorbjorn Sigurgeirsson and K Alan Yamakawa Revs Modern Physics 21 124-132 (1949) Jan

Previous measurements [Phys Rev 71 319 (1947)] which suggested a systematic trend with atomic number in the number of decay electrons emitted when sea level mesons of assorted polarities are stopped in various materials have been extended. From these data it has been concluded that the division between elements of high and low electron emission comes in the neighborhood of atomic number $Z_0 \sim 10$; where Z_0 is the atomic number of the idealized nucleus for which meson decay and the specifically nuclear meson disappearance reaction have equal probabilities. This constant provides a means to determine the strength of coupling of the meson field to the nucleus [Tiomno and Wheeler, Revs Modern Physics 21 153 (1949)]. It was also found that the decay curves for mixed sea level mesons, 0.75 μsec. after the arrival of the meson, show a relatively small difference from element to element, as expected from simple theoretical arguments. Extensive tabulated data obtained in this survey are given for the behavior of negative mesons, as affected by the atomic number of the moderator. Detailed data are given for sulfur, while data obtained for the following moderators are summarized: Be, B_4C, C, Teflon, NaF and Mg.

2098 Electrons and Photons in Cosmic Rays by Bruno Rossi Revs Modern Physics 21 104-112 (1949) Jan

Some recent experimental results are discussed which support the hypothesis that the variation in the number of electrons and photons in cosmic rays with altitude can be attributed to the creation of high energy electrons or photons by a rapidly absorbed primary radiation. The experimental data obtained by several investigators are summarized and analyzed to determine their consistency with the aforementioned hypothesis. From the calculations made it is evident that no obvious contradiction to this hypothesis exists in the data, although it is noted that some of the experimental data on which the analysis is based are very crude. It is concluded that it is reasonable to assume that the same hypothesis advanced for the electronic component of cosmic rays may also be applied to the production of mesons. The possibility that the production of the electronic radiation takes place through the intermediary of some sort of short-lived mesons is also suggested. The primary rays, generally assumed to be high energy protons, thus account for the origin of the electron, photon and meson components. The difficulty in reconciling this picture with data on the east-west effect at high altitudes is noted. 18 ref.

2099 Energy Spectrum of Electrons from Meson Decay by J Tiomno and John A Wheeler Revs Modern Physics 21 144-152 (1949) Jan

Since observations on the energy of electrons given off in the decay of ordinary sea-level or μ-mesons are inconsistent with the assumption of a two-particle decay process, it has been proposed [Moller as reported by Marty and Prentki, J Phys et Radium 9 148 (1948); Marshak, Phys Rev 73 1226 (1948)] to consider μ-decay as a three-particle process of the type: $\mu \rightarrow \mu_0 + \nu + e$, or, as a special case of this type, $\mu \rightarrow 2\nu + e$. Calculations of the shape of the energy spectrum to be expected on the hypothesis of decay into an electron and two neutral particles are reported. After treating the coupling between the meson and light particle field, the transition probabilities when μ_0 is not a neutrino are considered. The decay into two neutrinos and an electron is treated and the decay spectrum evaluated. The coupling constant is determined and the results obtained are compared with experiments. It is concluded that: 1) The three-particle hypothesis is consistent with present experimental evidence on the energy spectrum of electrons from μ-decay 2) Experimental evidence on the lifetime of the meson is consistent with the hypothesis that μ-decay and β-decay are separate instances of the same phenomenon, with the same coupling constant, $g \sim 2 \times 10^{-49}$ erg cm^3 3) The hypothesis of identical coupling constants and the use of 30 min. for the neutron half-life are consistent with the vector form of coupling if the second neutral particle has small mass, or is a neutrino; and with tensor coupling for the antisymmetrical two-neutrino theory 4) These considerations are purely phenomenological and as they stand are independent of deeper questions of meson theory.

COSMIC RADIATION AND MESONS (continued)

2100 The Mass of the Mesotron by Robert B Brode Revs Modern Physics 21 37-41 (1949) Jan

The only presently available method for measuring the charge of the meson is by studying the ionization produced per unit of path; mass data are then deduced from the ratio of charge to mass. The work of previous investigators in determining the meson mass is reviewed, and some new data obtained using new mass measuring equipment are discussed. The new equipment uses a permanent magnet, instead of the customary electromagnet, and so eliminates error due to the fluctuations in the magnetic field which occurred in earlier measurements. The apparatus used is diagrammed and discussed, and data obtained are shown in the form of a comparison of the frequency distribution of masses obtained by the author with those of previous workers, Fretter and Retallack [Phys Rev 70 625 (1946)]. From the three distributions, a weighted mass spectrum has been obtained. The mean of the author's measurements is $218 \pm 5\ m_e$ whereas that of the combined measurements is $215 \pm 2\ m_e$. Tracks for a positive meson of mass $215 \pm 20\ m_e$ and of a negative meson of mass $225 \pm 20\ m_e$ are shown. (The mass of the π-meson is calculated as 283 ± 7, using the 215 ± 5 mean value.) It is noted that there is some evidence for the existence of particles of mass less than 100 and that 8 particles lying in the 500-800 m_e range were also observed.

2101 Measurements of the Absolute Intensity of Cosmic Radiation at Sea Level by R A Montgomery Phys Rev 75 1407-1412 (1949) May 1

A cosmic-ray telescope is described which measures the absolute intensity of the cosmic radiation through the use of trays of overlapping Geiger counters to eliminate insensitive areas. The results obtained, carefully corrected for accidentals, counter efficiency, side showers, absorption, and barometric pressure, are compared with those of previous authors. The absolute intensity of the cosmic rays, j_o, in ionizing particles/unit solid angle/ cm^2/ min. has been determined as:

	3/4" wood overhead	no absorber
Transverse counters connected	0.695	0.705
Transverse counters unconnected	0.680	0.690

These results are approximately three per cent lower than the results obtained by Greisen [Phys Rev 61 212 (1942)].

2102 On the Effect of Lead above Apparatus for the Detection of Low Energy Mesons by G T Reynolds Revs Modern Physics 21 122-123 (1949) Jan

A direct experimental measurement has been made of the effect of placing lead above the apparatus of a slow-meson-detecting device in order to determine the magnitude of the effect and the optimum thickness of lead for observations concerned with a particular range of meson energy. Measurements were made of the counting rate for mesons having momenta between 10^8 ev/c and 2×10^8 ev/c as a function of the thickness of lead above the detecting apparatus. The data taken indicate that 9 inches of lead above the apparatus yields as great an increase in meson counting rate as can be obtained for practical purposes for mesons of the selected energy range. The results are in good agreement with earlier results for lead thicknesses greater than 20 cm.

2103 On the Origin of the Cosmic Radiation by Enrico Fermi Phys Rev 75 1169-74 (1949) Apr 15

A theory of the origin of cosmic radiation is proposed according to which cosmic rays are originated and accelerated primarily in the interstellar space of the galaxy by collisions against moving magmetic fields. One of the features of the theory is that it yields naturally an inverse power law for the spectral distribution of the cosmic rays. The chief difficulty is that it fails to explain in a straightforward way the heavy nuclei observed in the primary radiation.

COSMIC RADIATION AND MESONS (continued)

2104 On the Range of the Electrons in Meson Decay by J Steinberger Phys Rev 75 1136-1143 (1949) Apr 15

An experiment has been carried out at altitudes of 600 feet and 14,200 feet, to determine the absorption of the electrons emitted in the decay of cosmic-ray mesons. Approximately 8000 counts have been obtained, using a hydrocarbon as the absorbing material. These data are used to deduce some features of the energy spectrum of the decay electrons. The resolution of the apparatus is calculated, taking the geometry, scattering, and radiation into account. The results indicate that the spectrum is either continuous, from 0 to about 55 Mev with an average energy ~ 32 Mev or consists of three or more discrete energies. No variation of the lifetime with the thickness of the absorber is observed. The experiment, therefore, offers some evidence in favor of the hypothesis that the μ-meson disintegrates into 3 light particles.

2105 Production of Mesons by Electrons by I N Sneddon and B F Touschek Nature 163 524 (1949) Apr 2 (Letter to the editor)

The probability of producing mesons by electron bombardment has been investigated. The simplest such reaction: $e + P \rightarrow e' + P' \rightarrow e' + N + \pi^+$ is discussed and the resemblance to the production of quanta in radiation processes is noted. For energies at which the proton recoil is negligible and neglecting the small interaction terms of the Yukawa theory, it is calculated that for an energy of approximately 300 Mev, the cross-section for the reaction is of the order of $10^{-33}cm^2$. A second possible process is considered: $e + N \rightarrow e + P + \pi^-$. It is noted that in this case a small correction is necessary to account for the electrostatic interaction between the meson and proton. For nuclei of larger Z than hydrogen, it is found that the cross sections for the proton and neutron cases, respectively, must be multiplied by AZ (for positive mesons) and by A(A-Z) (for negative mesons). In addition, in the case of heavy atoms and moderate meson energies a Gamow factor expressing the effect of the nuclear charge on the mesons has to be taken into account. This factor favors the production of negative rather than positive mesons. The cross-section for the production of mesons by the bombardment of a heavy nucleus with 300-Mev electrons is of the order $10^{-29}cm^2$.

2106 Some Consequences of the Electromagnetic Interaction between μ^- - Mesons and Nuclei by John A Wheeler Revs Modern Physics 21 133-143 (1949) Jan

Those features of the behavior of mesons which are largely independent of the uncertainties about the nature of elementary particles are investigated. The following topics are considered: 1) the potential of interaction of meson and nucleus; 2) the energy levels of negative mesons; 3) the probabilities of transition between the lowest energy levels; 4) meson-induced fission; and 5) the dependence upon atomic number of the probability of the meson charge exchange reaction.

2107 The Time Distribution of Decay Electrons from Mesons Stopped in Magnesium at 3500 Meter Altitude by A H Benade and R D Sard. Washington University Technical Report No. 3 (Office of Naval Research Contract) Mar 31 1949 37p (NP-759)

The time distribution of decay electrons from the natural mixture of positive and negative mesons stopped in 13.2 g/cm^2 magnesium at Climax, Colorado has been measured. The apparatus recorded delayed coincidences in ten contiguous 0.6 μsec channels covering delays from 0.5 to 6.5 μsec. The time distribution of false delayed coincidences due to G. M. tube lags was also measured. These lags are shown to affect only the data from the first delay channel (0.5 to 1.1 μsec), and an approximate correction for this effect can be made. Corrections for accidental delayed coincidences are also applied. The results (based on 2869 delayed coincidences) lie on a smooth differential decay curve, closely fitting the composite decay curve calculated on the assumption of competition between capture and decay for negative mesons. The effective mean life of the negative meson is definitely less than 2.15 μsec, and appears to be approximately 1.0 μsec. The results can also be fitted by a single exponential of mean life 1.7 ± 0.1 μsec.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2108 Jig for Alignment of X-Ray Samples by P J Hagelston and H W Dunn. AECU-205 Mar 18 1949 10p

A design of a combination alignment jig for x-ray samples is described. This jig is used, in conjunction with a small telescope, for lining up samples to be used with (a) the rotating sample mount for the G. E. powder camera, (b) the sample mount for the G. E. back-reflection camera, and (c), the sample mount on the new vacuum camera in use in this laboratory.

2109 Neutron Diffraction Study of the Structure of Ice by E O Wollan, W L Davidson and C G Shull Phys Rev 75 1348-1352 (1949) May 1

The crystal structure of ice in which the location of the hydrogen atoms cannot be determined by X-ray means, has been studied by the neutron diffraction technique. The intensities in the neutron diffraction pattern from a powdered sample of heavy (D_2O) ice, maintained at -90°C, were measured and compared with the intensities which would result if ice possessed any one of four proposed structures. The oxygen atom positions have already been determined from X-ray measurements and the proposed structures are considered here with respect to the location of the hydrogen (or deuterium) atoms. The structures considered are (a) the Barnes [Proc Roy Soc London A 125 670 (1929)] model, in which the hydrogen atoms are midway between oxygen atoms, (b) the Bernal and Fowler model (J Chem Phys 1 515 (1933)) which maintains a molecular grouping of two hydrogen atoms close (0.96A) to each oxygen atom with a definite repeating orientation, (c) a model consisting of hydrogen molecules rotating about the oxygen atoms as centers, and (d) the Pauling model (J. Chem Soc 57 2680 (1935)) suggested on the grounds of a residual entropy at low temperatures, in which hydrogen molecules possess some randomness of orientation under the restriction that one and only one hydrogen atom lies on each of the lines joining one oxygen atom to its neighbor. Structures (a), (b), and (c) are definitely ruled out by the neutron measurements while the Pauling structure agrees well with the data.

FLUORINE AND FLUOROCARBONS

2110 The Heat of Fluorination of Cobaltous Fluoride and the Heats of Reaction of Cobaltic Fluoride with Hydrogen and Bis(Trifluoromethyl) Benzene by Ralph S Jessup, F G Brickwedde and Martin Wechsler. AECD-2589 Mar 17 1949 Decl May 13 1949 13p Proposed for publication in J of Amer Chem Soc

Calorimetric measurements of the heats of the following reactions have been made and the following results obtained:

(1) $2CoF_2(c) + F_2(g) = 2CoF_3(c)$, $-\Delta H(250°C) = 56.1 \pm 2.0$ kcal; (2) $C_6H_4(CF_3)_2(g) + 14CoF_3(c) = C_6F_{10}(CF_3)_2(g) + 14CoF_2(c) + 4HF(g)$, $-\Delta H(335°C) = 409 \pm 14$ kcal; (3) $2CoF_3(c) + H_2(g) = 2CoF_2(c) + 2HF(g)$, $-\Delta H(335°C) = 74 \pm 4$ kcal.

The values given for the heats of reactions (1) and (3) are consistent, within the assigned probable errors, with available data on the heat of formation of HF.

HEALTH PROTECTION

2111 Five Channel Counter for Detecting Beta-Gamma Contamination of the Hands and Feet by R Sloss and S M Zollers. AECU-197 Apr 12 1949 10p

The equipment described is designed to operate automatically to indicate the degree of radioactive contamination on five selected areas of a subject. The five selected areas are: right hand back, right hand palm, left hand back, left hand palm, soles of shoes. Counts from the five areas are separately channeled into five counting and recording systems. The reference level for contamination counting which is called "background", includes all counts recorded by the system (from whatever source) when no subject is standing on the pedestal during the period when the "subject-background" switch is in the background position. In operation, the system compares the counts recorded by the equipment, when a subject is in position on the pedestal, with the previously made background count and indicates one of three levels of contamination relative to the background count by illumination of either a green, yellow or red indicator lamp.

HEALTH PROTECTION (continued)

2112 Method of Maintenance and Transfer across Contamination Barrier Using Plastic Bags by W A Hartman. AECU-198 Mar 24 1949 23p

A method has been devised for transferring materials across a contamination barrier by means of a vinyl plastic bag. This bag protects personnel from direct contact with injurious materials and is so manipulated that the seal across the barrier remains unbroken. The mitten, which is an integral part of the bag, permits freedom of movement in performing normal maintenance and assembly operations within contaminated regions. As a result of the normal procedure, materials and equipment which are removed from contaminated regions are safely packaged. Variations of this method permit the handling of heavy equipment and liquids. This system of transfer was successful in controlling the spread of a fluorescent powder tracer. No escaping particles of this powder were observed. The sensitivity of these fluorescent powder tests was such that a single particle of powder as small as 32 microns in diameter could be observed with the naked eye under ultra-violet light.

2113 Non-Occupational Berylliosis by Merril Eisenbud, R C Wanta, Cyril Dustan, L T Steadman, W B Harris and B S Wolf. AECU-201 Mar 16 1949 24p

Eleven cases of chronic berylliosis have been reported among residents of a community in the vicinity of a beryllium producing plant. In none of these cases was there any history of occupational exposure to beryllium. Ten of these cases resided within 3/4 mile of this plant and are believed to have been produced by atmospheric pollution originating in the plant effluent. One case, residing 1-3/4 miles from the plant, was a woman whose husband was employed in the beryllium plant; it is believed her exposure occurred in the handling of her husband's work clothes. It is estimated, on the basis of continuous air samples during a ten week test period, meteorological considerations, and production figures, that the average 3/4 mile concentration during the seven years in which this plant was in large scale production, was less than 0.1 microgram of beryllium per cubic meter of air. In the neighborhood of a plant producing or processing beryllium or its compounds, the concentration of beryllium in air should not be permitted to exceed 0.01 microgram per cubic meter for extended periods of time. The air analysis data, when related to the measured effluent from this plant, are found to be in excellent agreement with the concentrations predicted by theory.

2114 Development of Continuous Jet Impaction Method for Determining Air-Borne Contaminants by L Baurmash, L Curtis, F A Bryan and B Cassen. AECU-206 Mar 1 1949 13p

A continuous method of air sampling based on impaction methods has been in operation. The collecting cycle can be varied so that the sampling unit can be used for various types of collections. Variations due to changes in air-borne dust concentrations are readily visible. This type of continuous recorder is said to have as its prime advantage over other concentration recorders the fact that it will indicate the actual variations continuously over the entire sampling cycle while other sampling units will only show cumulative variations for given sample intervals. Also, the type of record obtained is of permanent nature and samples can be prepared for chemical and spectrographic analyses.

2115 Exposure to Radioactive Products Becomes a Concern of Industry by E C Barnes Ind and Power 56 87 (1949) May

The importance of adequate health protection of employees handling radioactive materials is noted. The three important factors in devising protective measures in such cases are distance, absorption by other materials, and time. Although previously the maximum safe exposure has been set at 0.1 r per day, it is noted that some indications of a lower safe limit have resulted in a few groups adopting a lower limit of 0.05 r per day. The simple photographic film badge and pencil meter, in common usage as simple detectors, are described.

HEALTH PROTECTION (continued)

2116 Some Public Health Problems in Nuclear Fission Operations by Arthur E Gorman and Abel Wolman Amer J Pub Health 39 443-454 (1949) Apr

Problems and future developments of enviromental and industrial sanitation within the nuclear fission industry are discussed from the point of view of the public health engineer and the industrial hygienist. The nature of nuclear fission operations, the dangers of various radioactive byproducts, problems of water supply contamination by radioactive substances, various existing disposal techniques, and tolerance limits are enlarged upon. The objectives of the sanitary engineer are to meet continued expansion with greater control measures, and to promote more intensive training programs to supplement personnel.

INSTRUMENTS

2117 A Magnetically Controlled Quartz Fiber Balance by R R Baldwin and F C Edwards. AECD-2576 nd Decl Apr 29 1949 For publication in NNES

The design, construction, and uses of an electromagnetically controlled quartz fiber microbalance are given. The balance, which fits in a 25 mm pyrex tube, may be used to measure weight differences of the order of 10^{-7} gms in a completely closed system, controlled externally by a variable magnetic field.

2118 A Method of Assymetrical Pulse Duration Modulation by Richard John Watts. AECU-204 nd 5p

This paper describes the manner in which the pulse-height discriminator may be used as the basis of a method of pulse duration modulation. The pulse-height discriminator is in general based on the Schnutt trigger circuit [J Sci Instruments 15 24 (1938)]. Diagrams of the circuit are given.

2119 A Differential Electronic Circuit by H E Gove. National Research Council of Canada Report PD-197 nd 9p

This paper describes the operation of a differential electronic circuit employing a double valve with a common cathode. The general circuit is shown and it is analyzed in the conventional manner by using an equivalent circuit.

2120 Distortion-free Electrostatic Lenses by T Mulvey and L Jacob Nature 163 525-526 (1949) Apr 2 (Letter to the editor)

An investigation of the degree of distortion present in symmetrical lenses of the three-aperture type (radius 2 mm, separation 4 mm) was undertaken with a view to determining whether they can be used in electron microscopy. Curves of the distortion as a function of the ratio of thickness to diameter for various separations are shown.

2121 A New Fluorescent Screen for the Electron Microscope by K B Merling Nature 163 541-542 (1949) Apr 2

A new fluorescent screen for the electron microscope, composed of silver-activated zinc-cadmium sulfide, is described. The performance of the screen is compared with that of the commonly used willemite type. In addition to an improvement in brightness and resolution, the zinc-cadmium sulfide screen offers the advantage of showing all the detail registered on the photographic plate. Photographs illustrating the increased efficiency obtainable with the new screen are shown.

2122 Plotting Electron Trajectories by K F Sander, C W Oatley and J G Yates Nature 163 403 (1949) Mar 12 (Letter to the editor)

A new method of tracing electron trajectories in electron optical systems has been developed which consists essentially in the use of a differential analyser to integrate the equations of motion of an electron; the components of acceleration are continuously determined by automatic measurements in an electrolytic tank. The tests made using an electrostatic two-cylinder lens are in agreement with the available theoretical data and the error is estimated as only 1% for f and slightly greater for C,

INSTRUMENTS (continued)

the spherical aberration coefficient. In addition to simple ray racing, including skew paths, the machine appears to be suitable for solving more complicated problems, including the effect of space charge, both by exact and approximation methods, and for tracing trajectories in time-varying fields. It is noted that it is possible to make exact allowance for relativity effects when this method is used.

ISOTOPES

2123 Search for Stable Pd^{100}, W^{178} and Pb^{202} by Henry E Duckworth, Robert F Black and Richard F Woodcock. AECU-202 Apr 6 1949 6p

Limits of abundance for stable isotopes have been assigned as follows: Pd^{100} less than 0.0007% (same limits for Pd^{98}, Pd^{99} and Pd^{101}); W^{178} less than 0.0001% (same for W^{179} and W^{181}); Pb^{202} less than 0.0004% (same for Pb^{203}, Pb^{201} and Pb^{200}).

2124 He^3 Isotopic Abundance by J H Coon Phys Rev 75 1355-1357 (1949) May 1

This article is based on AECD-2207. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-955.

METALS AND METALLURGY

2125 Self-Diffusion of Metals and Associated Phenomena by Ben H Alexander and George C Kuczynski. AECU-199 Mar 1 1949 40p

A method of determining the self-diffusion coefficients of metals has been developed and results for silver and iron have been obtained. The behavior of a truly viscous material under the same experimental conditions has been demonstrated. A study of the process of spheroidization has been initiated and preliminary results are presented. It has been shown that copper diffuses faster into nickel than nickel into copper.

2126 Elastic Constants and Sound Velocities I. The Precision Determination of Elastic Constants by Henry L Laquer. AECU-203 Mar 3 1949 65p

This report deals with work done on the elastic constants of and sound velocities in a number of heavy metals which are of interest on the project. The work has been limited to observations in the vicinity of room temperature and at atmospheric pressure. The relevant elastic theory is briefly summarized and the experimental technique is described. 43 references.

2127 Measurements on the Oxidation-Resistance of High Melting-Point Alloys by O Kubaschewski and A Schneider J Inst Metals 16 403-416 (1949) Feb

The resistance to atmospheric oxidation of binary and ternary high-melting-point alloys was investigated at 1250° C. The apparatus used for these experiments is described. X-ray, microscopic examinations and Brinell hardness measurements were carried out at room temperature. The alloy systems which were investigated are, chromium-tungsten, chromium-molybdenum, chromium-tantalum, chromium-niobium, chromium-tantalum-niobium, chromium-niobium-tungsten, niobium-nickel, and chromium-niobium-nickel.

2128 Neutron Diffraction Studies of Order-Disorder in Alloys by C G Shull and Sidney Siegel Phys Rev 75 1008-1010 (1949) Apr 1 (See also NSA No. I-311)

Neutron diffraction techniques have been used to study order in the substitutional solid solutions FeCo, Ni_3Mn, and Cu_3Au. Superlattice effects have been found in the first two examples, which are difficult to study by x-rays. Neutron diffraction patterns for ordered and disordered samples of the aforementioned alloys are shown.

METALS AND METALLURGY (continued)

2129 Oxidation-Resistance and Some Phase Relationships in the System Chromium-Tantalum-Nickel by O Kubaschewski, and H Speidel J Inst Metals 16 417-430 (1949) Feb

Thermal, microscopic, and x-ray methods were used in a preliminary investigation of the constitution of the systems chromium-tantalum, nickel-tantalum, and chromium-tantalum-nickel. Results of high-temperature oxidation tests on the systems nickel-tantalum, and chromium-tantalum-nickel are given. The oxidation properties can be improved by small additions of less noble metals. Good results are obtained by adding up to 1 or 2% of calcium, thorium, silicon or beryllium. Several diagrams and photomicrographs are included.

2130 Powder Metallurgy and Heat-Resisting Alloys by H W Greenwood Engineer 187 349-351 (1949) Apr 1

The author discusses the development of the conventional heat resistant alloys and states that they have reached their ultimate limit. Further development in materials to withstand higher temperatures will be along the lines of powder metallurgy. The melting points of some materials such as the carbides, borides, and oxides of titanium, tungsten, zirconium, etc. are given. These range from 1350°C to 3877°C. A few of the latest developments in powder metallurgy are also presented.

2131 Vaporization of Titanium by L G Carpenter and Frank R Reavell Nature 163 527 (1949) Apr 2 (Letter to the editor)

The rate of evaporation of titanium wires in vacuo has been measured over the temperature-range 1,650 - 1,800°K. The results can be expressed as $\log_{10} ET^{1/2} = \frac{-2.07 \times 10^4}{T} + 7.70$, where E is expressed in gm $cm^{-2}sec^{-1}$. From this the latent heat of vaporization in this temperature-range is 95 kilo-cal per mole. It was also found that the variation of total radiation with temperature is proportional to $T^{4,4}$, the emissivity at 1,700°K being about 30% of that of a black body.

MICROWAVE PHENOMENA

2132 The Generation of Harmonics by Silicon and Germanium Crystals by Dorothy D Montgomery. MIT Radiation Laboratory Report RL-818 Oct 23 1945 9p

Comparisons were made of the harmonic generating qualities of silicon and welded-contact germanium crystals, respectively. Measurements were made upon the production of the second harmonic of three centimeter radiation and of one centimeter radiation. The germanium crystals were found to be somewhat superior to the silicon notably so for the generation of the third harmonic.

2133 An Improved Frequency Stabilization System for Microwave Oscillators by R V Pound. MIT Radiation Laboratory Report No. RL-837 Oct 26 1945 16p

This report contains a discussion of an electronic frequency stabilization system for microwave oscillators. This system is considered to be capable of greater ultimate stability than the system described in Report 815 because it eliminated the dc amplifier of that system as well as the effect of low frequency crystal noise. All of the amplification is done at a convenient intermediate frequency so that the difficulties of dc level and drifts are eliminated. It is not so easily frequency modulated and is not capable of being tuned by single knob control over so wide a band as the previous system, however. The system has been found experimentally to give better stability against both long and short time drifts than has been produced by the previous system.

2134 Special Report on Signal-to-Noise Measurements on Receivers. MIT Radiation Laboratory Report No. RL-108 Sept 29 1941 12p

It has been found that different laboratories have been using varying reference standards in comparing the performance of actual receivers with that of ideal receivers. The meaning of a statement that a given receiver is so many db poorer in signal-to-noise ratio than an ideal one depends on the definition of the ideal receiver and on what measured quantity is compared with what calculated one. This report brings out the main points involved by detailed discussion of one method of measurement and the relevant theory, and makes some recommendations as to the reporting of results of such measurements in order that further confusion may be avoided.

MICROWAVE PHENOMENA (continued)

2135 T-Junctions in Rectangular Wave Guides. Part I: Theory by N H Frank and L J Chu. MIT Laboratory Report No. RL-179 July 27 1942 14p

The theory of the propagation of electromagnetic waves in wave guide systems containing a T-junction is presented. The dimensions of the guides are so taken that only the lowest TE mode can propagate and the plane of the T is parallel to the electric field in the guides. The results are reduced to a simple form said to be suitable for engineering applications.

NEUTRONS

2136 Relativistic Treatment of Neutron-Proton Elastic Scattering in the Born Approximation by Frederick Alzofon. AECU-213 Mar 18 1949 43p

At a kinetic energy of 90 Mev a neutron or proton (rest mass 938 MEV) possess a total energy of 1028 Mev, $v/c = \beta = 0.409$, and $\gamma = (1 - \beta^2)^{\frac{1}{2}} = 1.10$. These values indicate a relativistic treatment of n-p scattering to be necessary, taking into account retardation of the meson fields through which the n-p interaction is assumed to take place. Formulas are derived for n-p elastic scattering using a field theory method with interaction Hamiltonian terms given by Keuner [Proc Roy Soc 166A 127 (1938)].

2137 Neutron Absroption Cross Sections of Radioactive La^{140} and Two Stable Cerium Isotopes by S Katcoff, J A Leary, K A Walsh, R A Elmer, S S Goldsmith, L D Hall, E G Newbury, J J Povelites and J S Waddell J Chem Phys 17 421-424 (1949) Apr

This article is based on AECD-2174. An abstract of this document has been listed in Nuclear Science Abstracts as Abstract No. 1-975.

2138 The Neutron Pile as a Tool in Quantitative Analysis; The Gallium and Palladium Content of Iron Meteorites by Harrison Brown and Edward Goldberg Science 109 347-353 (1949) Apr 8

This article is based on AECD-2296. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-1292.

2139 Neutrons and Gamma-Radiation from Deuteron Bombardment of Be by J E Evans, C W Malich and J R Risser Phys Rev 75 1161-1168 (1949) Apr 15

Neutron and γ-ray intensities from thin targets of Be bombarded by deuterons were measured as a function of deuteron energy from 0.2 to 1.8 Mev. Most of the neutron data were obtained in the forward direction with respect to the deuteron beam. Neutron and γ-ray intensities show an exponential increase with energy below 800 Kev; a broad resonance in the region 1.0 to 1.1 Mev is indicated by the shape of the curve at energies above 800 Kev. No sharp resonances were found. Evidence for a previously unknown neutron group of Q equal to -0.7 Mev is given. Neutron intensities were measured as a function of angle with the deuteron beam for a number of bombarding energies from 0.8 to 1.7 Mev.

2140 Non-Central Interactions between Neutron and Proton by Tsi-Ming Hu and H S W Massey Proc Roy Soc London 196 A 135-159 (1949) Mar 22

Assuming various non-central interactions between neutron and proton of the form

$$\nu = -\frac{1}{2}(1 + \tau_1 \cdot \tau_2)\left\{ -\frac{\hbar^2}{M}\frac{a}{r_0^2}\left[1 + \tfrac{1}{2}g(\sigma_1 \cdot \sigma_2 - 1) + \gamma\left(\frac{3\sigma_1 \cdot r\, \sigma_2 \cdot r}{r^2} - \sigma_1 \cdot \sigma_2\right)\right]\right\} V(r/r_0),$$

(where $\sigma_1, \sigma_2, \tau_1, \tau_2$ are the spin and isotopic spin operators of the particles, r the distance between them). Calculations concerning the following have been made: (1) the magnetic moment of the detueron, (2) the scattering of neutrons having energies up to 20 Mev by protons, and (3) the photodisintegration of deuterons by high energy γ-rays (17-20 Mev). The constants a, g, and γ have been determined for different values of the range r_0 for 3 different shapes of the function V (i.e., spherical well, exponential and Yukawa forms), so as to obtain the correct binding energy of the ground state, the quadrupole moment of the deuteron and the low velocity neutron-proton cross-section. Using chosen values of r_0, further

NEUTRONS (continued)

calculations were made for the 3 forms of the exchange operator for each "shape" of V. A comparison of the ranges obtained for the different assumed potential functions is given. 8 tables 43 references.

2141 Radioactivity Induced in Ytterbium by Neutron Bombardment by J M Cork, H B Keller, W C Rutledge, A E Stoddard and J Sazynski Phys Rev 75 1133-1135 (1949) Apr 15

A specimen of ytterbium, submitted to a long irradiation in the pile, showed a prolific yield of electron lines as a result of internal conversion. These lines appeared in part caused by radioactive ytterbium and the remainder indicated the presence of activated erbium. Each element displayed some lines of short half-life and some of half-life 105 days or longer. In the case of ytterbium four γ-rays were associated with the short lived activity and five γ-rays were found to persist. In erbium there were five γ-rays which died out rather quickly and seven γ-rays characteristic of the long half-life. On considering the total γ-emission from each element, it is possible by virtue of many mathematical identities between the energies to propose a plausible level structure for each product nucleus following β-emission from isomers.

2142 The Scattering of High Energy Neutrons by Nuclei by S Fernbach, R Serber and T B Taylor Phys Rev 75 1352-1355 (1949) May 1

This article is based on AECU-101 (UCRL-262). An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 2-1225.

2143 Some Remarks on the Capture Cross Sections of the Heavier Elements for Slow and Fast Neutrons (Einige Bemerkungen zu den Einfangquerschnitten langsamer und schneller Neutronen bei schwereren Elementen) by Lise Meitner Ann Physik 3 115-119 (1948) (In German)

The very low value (about $10^{-27}cm^2$) of the capture cross section of Pb and Bi for slow neutrons was determined by Muelhouse and Goldhaber [Phys Rev 70 85 (1946)] and Maurer and Ramm [Z Physik 119 602 (1942)]. These 2 elements show also abnormally small capture cross sections for fast neutrons. The present author came across another example of this phenomenon by irradiating with fast neutrons a preparation of Cb + 2% Ta: the capture cross section for $Ta^{181}(n,\gamma)T^{182}$ was found to be 500 times larger than that for $Cb^{93}(n,2n)Cb^{92}$. The following experiments were made in order to determine which of the elements, Ta or Cb, behaved abnormally. In one experiment, samples of a pure Ta preparation were irradiated with fast and with slow neutrons; the measurement of the products' 2 activities (9 hr and 18 min half-life periods) gave for the ratio fast/slow the value 1.5 and 2, respectively. In another experiment, similar ratios were determined for Ta and Au: the ratio was found to be 3.4 times larger for Ta than for Au. These results show that the originally observed abnormal difference in the behavior of Ta and Cb was due to a very low value of the capture cross section of Cb for fast neutrons. Wu, Rainwater and Havens [Phys Rev 71 174 (1947)] found that for slow neutrons also the capture cross section of Cb is small: it is 30 times smaller than that of Ta, in the same energy interval. It is thus established that Cb shares with Pb and Bi the property of possessing very small neutron-capture cross sections. The author does not agree with Maurer and Ramm who attempted to explain the abnormal behavior here studied by the supposed existence of certain spin selection rules.

2144 Total Cross Section of Be, O, Na, and Ca for Fast Neutrons by R K Adair, H H Barschall, C K Bockelman and O Sala Phys Rev 75 1124-1127 (1949) Apr 15

The total cross sections of Be, O, Na and Ca have been investigated as a function of neutron energy in ranges between 30 and 1000 Kev. A procedure which has been previously described [Seagondollar and Barschall, Phys Rev 72 439 (1947)], and which gave a resolving power of approximately 20 Kev, was used. Resonances were observed in Be at 625 Kev, and in 0 at 440 Kev, which were attributed to p-neutrons. In the case of the resonance observed for 0, it is suggested that the p-neutrons form a compound nucleus of spin 3/2. Numerous peaks were also found for Ca and Na. It is noted that the cross section of Ca is less than 1.5 barns over a considerable energy range.

NEUTRONS (continued)

2145 The Total Cross Section of the He_3 Nucleus for Slow Neutrons by L D P King and Louis Goldstein Phys Rev 75 1366-1369 (1949) May 1

This article is based on AECU-127 An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 2-1388.

NUCLEAR PROPERTIES

2146 Nuclear Moments of Silver by M F Crawford, A L Schawlow, W M Gray and F M Kelly Phys Rev 75 1112 (1949) Apr 1 (Letter to the editor)

The AgI resonance line $5s^2S_{1/2} - 5p^2P_{3/2}^o$ (3281A) has been excited in an atomic beam light source and its hyperfine structure resolved with an aluminium-coated Fabry-Perot etalon. Spectrograms were taken with 2-, 4-, and 5-cm etalons. The relative wave numbers of the four components in decreasing order are: (a) 0.000, (b) -0.013, (c) -0.055, (d) -0.077 cm^{-1}. The relative intensities of these components, are: (a):(b) = 1.00:1.05 $\pm$ 0.03; (c):(d) = 1.05 $\pm$ 0.03:1.00; (a) + (b):(c) + (d) = 1.00:0.33 $\pm$ 0.02. These values agree with the assignment of components (a) and (d) to Ag^{109} and components (b) and (c) to Ag^{107}, and show I = 1/2 for each isotope. The nuclear magnetic moments of the two isotopes have been evaluated using the Goudsmit formula [Phys Rev 43 636 (1933)] with the addition of the Fermi-Segrè correction factor [Zeits f Physik 82 729 (1933) and Reale Accad D'Italia - Scieze Fisiche, Mat E Naturali Memorie 4 131 (1933)] determined from a Rydberg-Ritz formula and a correction for the finite size of the nucleus [J E Rosenthal and G Breit Phys Rev 41 459 (1932)]. The nuclear magnetic moments obtained are: $\mu(Ag^{107}) = -0.086$ and $\mu(Ag^{109}) = -0.159$ nuclear magneton.

2147 On the Existence of an Excited State of the Deuteron by S Nakagawa J Sci Res Institute (Tokyo) 43 10-20 (1948)

Using Flügge's interaction potential the effects of an excited state of the deuteron on the properties of the two-particle neutron-proton system has been investigated. The values obtained for the total cross sections of various neutron-proton interactions were in fair agreement with the experimental values, when the range of nuclear forces used was 2.3×10^{-13} cm and an excited state $^3P_1$ at 0.8 Mev was assumed.

NUCLEAR TRANSFORMATION

2148 Distribution in Mass and Charge of Fission Products by K H Kingdon. AECD-2579 Sept 8 1947 Decl May 3 1949 5p Proposed for publication in Phys Rev

It is not well understood why fission products are divided into two distinct mass groups separated by a marked minimum. This note makes a suggestion concerning this problem. When a nucleus of U^{235} picks up a slow neutron, it may become so distorted that ultimately it separates into two major fragments. It is reasonable to assume that this fission will occur in such a way as to produce fragments having the greatest ability to bind the excess neutrons which were present in the parent distorted nucleus. The ability of a nucleus to bind neutrons may be measured by (A-Z)/Z, so that isotopes of stable elements having particularly high values of (A-Z)/Z may be expected to be prominent among the fission products. This hypothesis affords no criterion of the possibility of fission, but merely attempts to tell what the fragments will be if fission does occur. Data are presented graphically supporting this hypothesis.

2149 Spallation Products of Arsenic with 190 Mev Deuterons by H H Hopkins Jr. AECU-212 Mar 21 1949 51p

Purified arsenic has been bombarded with 190 Mev deuterons. Following chemical separation of chlorine and the elements chromium through selenium, an analysis of the radioactivities in each fraction showed the presence of a total of 40 isotopes. An estimation of the yields of these isotopes has been made, and using the observed trends, yield figures were assigned to those isotopes which could not be observed. For a given value of Z (or A), the yields rise steadily to a maximum and then decrease; the line of maximum yields lies above the line of stability at masses 73 to 67, approaches it below. The yields of elements from arsenic to manganese decrease smoothly. Isotopes within a few mass units of arsenic must be formed by non-capture excitation processes, those farther away by capture processes followed by the emission of neutrons, protons and alpha particles. The chlorine isotopes are formed by the exclusive emission of alpha particles and neutrons.

NUCLEAR TRANSFORMATION (continued)

2150 Low Energy Cross-Section of the D - T Reaction and Angular Distribution of the Alpha-Particles Emitted by E Bretscher and A P French Phys Rev 75 1154-1160 (1949) Apr 15

This article is based on AECD - 2211. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-1010.

2151 Neutron-Hydrogen Mass Difference from the $T^3(p,n)He^3$ Reaction Threshold by R F Taschek, G A Jarvis, H V Argo, and A Hemmendinger Phys Rev 75 1268-1269 (1949) Apr 15 (Letter to the editor)

The threshold for the reaction $T^3(p,n)He^3$ has been measured by observing the neutrons produced when protons from the Los Alamos electrostatic generator strike a target of tritium absorbed in zirconium [Graves, et al. private communication, to be published in Rev Sci Instruments]. The absolute value of the threshold energy was established relative to the highly accurate $Al(p,\gamma)$ resonance at 993.3 Kev quoted by Herb, Snowden, and Sala [Phys Rev 75 246 (1949)]. Gamma-rays were counted in double coincidence at right angles to the proton beam and neutrons were counted at 0°. The width of the step in the γ-ray yields was about 2.0 Kev for Al and about 1.0 Kev for F. The thresholds for $T^3(p,n)He^3$ and $Li^7(p,n)Be^7$ were determined to plus 1/2 Kev and minus 1 Kev. Assuming the $Al(p,\gamma)$ resonance to lie at 993.3 Kev, it was found that the $F(p,\gamma)$ resonance occurs at 873.1 Kev and the $Li^7(p,n)Be^7$ threshold at 1880 Kev, in agreement with Herb, et al This scale then puts the $T^3(p,n)He^3$ threshold at $1019_{-1}^{+1/2}$ Kev, giving a Q value of −763.7 Kev, when the mass factor used was 0.749_5. Assuming a zero neutrino mass and a β-ray end point of 18.3 Kev this threshold measurement gives the n — H mass difference as 782 ± 1.5 Kev.

2152 A Study of the Interaction of Protons with Tritium by R F Taschek, G A Jarvis, A Hemmendinger, G G Everhart and H T Gittings Phys Rev 75 1361-1365 (1949) May 1

This abstract is based on AECD-2352. An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 1-1635.

2153 Value of the $Li(p,\gamma)$ Resonance by Emmett L Hudspeth and Charles P Swann Phys Rev 75 1272 (1949) Apr 15 (Letter to the editor)

The results previously reported [Bull Amer Phys Soc 24 No. 1, 18 (1949)] for a comparison of the fluorine and lithium resonances of the (p,γ) reactions have been obtained with a higher degree of accuracy. The quantity $\Delta V = (2V_{Li} - V_F)$, originally reported as 20 ± 6 Kev has been redetermined as 11.2 Kev from thin-target data. (V_{Li} represents the lithium resonance and V_F represents the fluorine resonance). Using $V_F = 873.5$, one obtains $V_{Li} = 442.4$ Kev, with an estimated over-all error of about 1.5 Kev. The tabulated data obtained for targets of various thickness are given.

PARTICLE ACCELERATORS

2154 A Study of X-Rays from the Berkeley Van de Graaf Generator by M R Jeppson and C M Turner. AECU-214 Mar 24 1949 9p

These are the results of a brief investigation of x-ray conditions produced by the 4 MV Van de Graaf Generator at the University of California Radiation Laboratory. The study was made to determine what personnel protection is required and to find what if any are the factors which will ultimately limit the beam size.

2155 First Large Synchrotron Placed in operation by W W Salsig Jr. AECU-219 Feb 23 1949 6p

The fastest particles yet produced in the laboratory, electrons with a velocity approaching that of light, have recently been realized in the University of California's 300,000,000 electron volt synchrotron. The synchrotron is described as an instrument of research, used to investigate the interaction of matter with x-rays and high speed electrons. It accelerates particles by adding thousands of small increments of energy to them as they are restrained by a magnetic field to a whirling circular orbit. Acceleration is effected by using a constant frequency accelerating voltage in conjunction with a varying magnetic

PARTICLE ACCELERATORS (continued)

field. Electron acceleration is accomplished in three successive stages: (1) injection, which gives the particles an initial boost of 90,000 volts, (2) "Betatron start" which brings the energy to 2 Mev and (3) synchrotron action, which takes the particles from 2 to 300 Mev. A description of the component units is presented. Comparative references to the cyclotron and bevatron are made.

2156 Accelerators of Electrons and Particles (Les accelerateurs d'électrons et de particules) by P Lapostolle Revue Générale De L'Electricité 57 473-480 (1948) Nov

In this review on particle accelerators, the principles of operation of the various accelerators are discussed and the limits of utilization, advantages, and disadvantages, are noted in each case. In particular, the synchrotron and the linear accelerator, which seem to be the most suitable for acceleration to high energies, are treated. 14 fig. 17 ref.

2157 Electrostatic Generators by J W Boag Science Progress 37 244-258 (1949) Apr

The historical development of the electrostatic generator is reviewed briefly and some of the features of modern equipment of this type are discussed. The principal topics treated are the following: (1) the insulating medium, (2) the factors influencing the maximum current, (3) the charging belt, (4) the measurement of voltage, (5) the control system, (6) the ion source and the accelerating tube. Future trends in design and the applications of electrostatic generators are also discussed.

2158 Experiments on the Effect of Gas Scattering on Betatron Output by H H H Watson Proc Phys Soc 62 206-207 (1949) Mar 1 (Letter to the editor)

Some preliminary measurements of the effect of gas scattering on the output of a 30-Mev synchrotron are described. In the experiments the synchrotron magnet was operated as a 4-Mev betatron at various excitation currents. By this method the time taken to accelerate the electrons to 4 Mev could be varied from 0.56 to 2.56 milliseconds. At each value of excitation current the X-ray output was measured as a function of pressure for each of 3 values of injection voltage, i.e. 10, 16 and 30 Kev. Graphs of the log of the output plotted against the pressure gave a straight line fitting the equation: $I = I_0 \exp[-Pft(V)]$, where I and I_0 are the X-ray intensities at P and zero mμ of mercury pressure, respectively; t is the acceleration time in milliseconds, and f(V) is some function of the injection voltage, V, measured in kilovolts. Tabulated values of f(V) are given as a function of t for the 3 values of V. For air, f(V) was determined empirically as $1.1\ V^{-1/2}$, while for hydrogen f(V) was found to be $0.09\ V^{-1/2}$. Some possible sources of error are noted. Since the doughnut had a fired-on platinum coating, which did not evolve gas, the variations of output with pressure were due only to the deliberately introduced gas. These results should provide helpful criteria for the maximum permissable gas pressure in a betatron or synchrotron. The author notes that the exponential form of the relationship obtained demonstrates the absence of any appreciable gas focusing of the electron beam.

PERIODIC TABLE

2159 Further Remarks on the Table of Chemical Elements (Weitere Bemerkungen zum Schema der chemischen Elemente) by Stefan Meyer and Agathe Koss-Rosenqvist Acta Phys Aust 2 245-254 (1949) Feb (In German)

In a previous paper [Acta Phys Aust 2 114 (1948)] the authors have presented a new arrangement of the elements. It is here shown that this arrangement accounts for the existence of isotopes (equal charges), isotones (equal numbers of neutrons), and isobars (equal masses). Certain regularities are described which can explain the existence of empty places in the periodic chart. From the authors' findings, recommendations are made for the re-examination of data on the existence and the properties of certain elements such as $_{20}Ca^{48}$, $_{37}Rb^{87}$, $_{50}Sn^{115}$, $_{51}Sb^{123}$, $_{54}Xe^{136}$, $_{62}Sm^{147}$, $_{76}Os^{184}$, and $_{80}Hg^{196}$.

PHYSICS, GENERAL

2160 Heat Transfer at High Rates to Water with Surface Boiling by W H McAdams, J N Addoms and W E Kennel. AECU-200 Dec 1948 78p

An investigation has been made to determine the effects of velocity, subcooling (the difference between the temperature of saturation and the bulk temperature of the water), pressure and annulus size on the heat transfer, with and without surface boiling, to water flowing upward in an annular space. The data on heat transfer to water were obtained in a test section which consisted of an electrically-heated stainless-steel tube (0.25 inch in diameter and 3.75 inches long) centrally located inside a glass jacket (ID of 0.43 to 0.77 inch), permitting visual observation and photographic study. Temperatures of the tube in contact with the water were obtained by measuring inside wall temperatures and correcting for radial gradient in the heated wall. Auxiliary equipment consisted of a closed circuit with the necessary instruments to control and measure the flow rate, pressure, and temperature of the water. A method of analysis for dissolved air in the substantially degassed distilled water was developed and employed. 83 references.

2161 Alpha-Particle Ionization in Argon and in Air and the Range-Energy Curves by William P Jesse and John Sadauskis Phys Rev 75 1110-1111 (1949) Apr 1 (Letter to the editor)

Recently obtained data on the relative ionization for individual samarium and polonium α-particles in air and in argon are discussed [Jesse and Forstat Phys Rev 73 926 (1948); 74 1259 (1948)]. The anomalous behavior of air in this respect is indicated by the data and the effect of such behavior on the α-range-energy curves in current use is considered. The corrections have been applied to the Holloway-Livingston α-range-energy curve [Phys Rev 54 18 (1938)] as well as to the proton range energy curve obtained by Bethe and Livingston [Revs Modern Physics 9 245 (1937)]. In addition derived values of the mass difference (n - H^1) from the three possible range-energy curves, i.e., uncorrected Bethe-Livingston, corrected Bethe-Livingston, and Parkinson, Herb, Bellamy and Hudson for the (n,p) reactions for N^{14} and He^3 are given in tabular form. The use of the corrected curve raises the (n - H^1) value from the formerly accepted value of 0.755 Mev to a value of 0.777 Mev.

2162 Determination of the Electron Energy Distribution in Gases from Townsend's Ionization Coefficient by H D Deas and K G Emeleus Phil Mag 40 460-465 (1949) Apr

A method for testing assumed forms of the energy distribution for electrons in gases by comparison of calculated and experimental value of Townsend's ionization coefficient α/p has been re-examined. It has been shown that no change is necessary in the previous conclusion that the experimental values of α/p are compatible, within the rather wide limits of experimental error, with the assumption that the energy distribution has a Maxwellian form for the larger values of X/p considered, in air, nitrogen and hydrogen, but that discrimination between different forms of the distribution function becomes increasingly less certain as X/p increases. New calculations for argon and neon again show that the distribution function falls off very rapidly with increase in energy above about the mean energy.

2163 On the Electric Dipole Moment and Vibrational States of $H_3B^{10}CO$ by M W P Strandberg, C S Pearsall and M T Weiss J Chem Phys 17 429 (1949) Apr (Letter to the editor)

The J = O $\rightarrow$ 1 rotational transition in $H_3B^{10}CO$ for the ground vibrational state, and for two excited vibrational states (v_1,v_2), with negative α's has been observed, but is, as yet, unassigned. Owing to rapid decomposition the quadrupole hyperfine structure was not observed. The data obtained using a high sensitivity spectroscope system, which combines an f-m method [Hershberger, J Applied Phys 19 411 (1948)] with a Stark detection scheme [Hughes and Wilson, Phys Rev 71 562 (1947)], are shown in tabular form.

PHYSICS, GENERAL (continued)

2164 On the Liberation of Ions by Electron Bombardment by I Filosofo and A Rostagni Phys Rev 75 1269-1270 (1949) Apr 15 (Letter to the editor)

The electrical breakdown between metallic electrodes in a high vacuum has been studied to determine a possible threshold for the emission of secondary ions from the anode, in order to eliminate the effect of residual gas the study was made in the low voltage range. The curves obtained for the liberation coefficient as a function of electron energy for a steel anode at various distances from the cathode are shown; a maximum is observed in each case. From the data it is concluded that it is difficult to explain the current observed as a mere effect of the ionization of the gas.

2165 Recent Changes and Additions in the Consistency Diagram of the Natural Atomic Constants by Jesse W M DuMond Phys Rev 75 1267 (1949) Apr 15 (Letter to the editor)

The consistency diagram of the natural atomic constants F, N_0, m and h^2 which was previously given by DuMond and Cohen [Revs Modern Physics 20 82 (1948)] has been extended to include the following three new determinations: (1) The new precision value of α (Taub and Kush, Nafe and Nelson); (2) The new precision value of $h/(m_0c)$ (DuMond, Lind and Watson; and (3) the new x-ray determination of h/e (Bearden).

PHYSICS, NUCLEAR

2166 The Proceedings of the American Physical Society Phys Rev 75 1279-1338 (1949) Apr 15

The American Physical Society held its annual meeting at New York on January 26-29, 1949. Abstracts of the numerous papers are given which include the following: Interaction Between Waves and Electrons Traveling Together by L Brillouin; A General Treatment of Methods for the Production of Polarized Neutrons by Morton Hammermesh; Kinetics of Nucleation Applied to Solid-State Problems by J H Hollomon; Special Properties of Active Isotopes Identified by the Mass Spectrometer by Mark Inghram; π-μ-Meson-Distinction with G-M Counters by Oreste Piccioni; Models and Methods in the Meson Theory by H Yukawa; Beta-Decay of Be^{10} and Theory of Beta-Decay by R E Marshak; The Spectrum of Be^{10} by Absorption by D J Hughes and C Eggler; Coincidences in Be^{10} Beta-Rays by S G Hughes and W E Stephens; Beta-Ray Spectra of C^{14} by L Feldman and C S Wu; Production of Radioactive Gases by Deuteron Bombardment of Gaseous Targets by H Brown and V Perez-Mendez; Radioactive Scandium and Vanadium by N L Krisberg and M L Pool; The Beta-Ray Spectra of Cu^{64} by R D Albert and C S Wu; The Slow Neutron Induced Activities of Germanium by Y H Woo, C E Mandeville, M V Scherb and W B Keighton; Disintegration of Ag^{110} into Isobars Pd 110 and Cd 110 by Fu-Chun Yu, Lin-Sheng Cheng and J D Kurbatov; Beta- and Gamma-Rays of Antimony 125 by Bernard D Kern, A C G Mitchell and Daniel J Zaffarano; Presence of a New Long-Lived Cs Isotope in Fission by Nathan Sugarman; The Characteristic Radiations of Praseodymium (142) by C E Mandeville; Gamma-Radiation from Neutron Activated Ytterbium by J M Cork, H B Keller, J Sazynski, A Stoddard and W C Rutledge; The Beta-Ray Spectrum of RaE by R Morrissey and C S Wu; Design of the Brookhaven High Energy Proton Synchrotron by M G White; Propagation of Electromagnetic Waves Guided by Magnetic Materials by John P Blewett; Effects of Eddy Currents on the Field of the Cosmotron Magnet by M Hildred Blewett; Dynamic Magnetic Measurements on Cosmotron Magnet Model by G K Green, H S Snyder and L W Smith; Experimental Facilities to be Available at the Brookhaven Nuclear Reactor by Clark Williams; Nuclear Reaction Energies as Integral Multiples of a Natural Unit by Enos E Witmer; The Masses of Nuclei from Neon to Chlorine by H T Motz and R F Humphreys; On the Production of $\pm$ Electron Pairs in the Field of an Electron by J A Phillips and P Gerald Kruger; Luminescent Spectra of Phosphors Useful in Scintillation Counters by J C D Milton and R Hofstadter; Pulse Size Distributions in Scintillation Counters by R Hofstadter, J C D Milton, and J A McIntyre; Resolving Times of Naphthalene and Polystyrene Counters by William J MacIntyre; Waveforms Associated with the Discharge of a Geiger Tube by G G Kelley, W H Jordan and P R Bell; Angular Distribution of Photo-Neutrons from Deuterium and Beryllium by Bernard Hamermesh and Albert Wattenberg; Photodisintegration of Deuterium and Beryllium by the Gamma-Rays of Na^{24} and Ga^{72} by Arthur H Snell, E C Barker and R L Sternberg; The Interaction of Protons with Tritium by A Hemmendinger, G A Jarvis and R F Taschek; Spectrum and Angular Distribution of Neutrons from Be + p by P C

PHYSICS, NUCLEAR (continued)

Gugelot; Comparison of Li(p,γ) with a F(p,γ) Resonance by Emmett L Hudspeth and Charles P Swann; Angular Distribution of $Li^6(d,\alpha)\alpha$. by Robert Resnick and D R Inglis; Neutrons from the $Be^9(d,n)B^{10}$ Reaction by J W Butler, J E Evans, C W Malich and J R Risser; Q Values from Alpha-Particle Bombardment of Boron by R J Creagan; Angular Distribution of End-Group Protons from B^{10} + d by W C Redman; Angular Yield of Protons from N^{14} (dp) N^{15} by L D Wyly; Ionization Chamber Observation of the Reaction $N^{14}(n,p)C^{14}$ by W Franzen, J Halpern, and W E Stephens; Proton Energies from $K^{39,41}(d,p)K^{40,42}$ by V L Sailor, Stopping of Fission Fragments in Gases by E C Campbell, W M Good and W A Strauser; A Precise Determination of the Slow Neutron Cross Section for the Free Proton by Edward Melkonian, L J Rainwater and W W Havens Jr.; Theory of Slow Neutron Scattering by G Placzek, Interaction of Neutrons with Electrons in Bismuth by L J Rainwater, I I Rabi and W W Havens Jr; The Neutron-Electron Interaction by M Slotnick; Slow Neutron Velocity Spectrometer Studies; Al, Cr, C, Fe, Ni by W W Havens Jr and L J Rainwater; The Scattering of Slow Neutrons by Paramagnetic Crystals by I W Ruderman, W W Havens Jr, T I Taylor and L J Rainwater; New Calculations of Multiple Scattering by H S Snyder and W T Scott, On Proton-Proton Scattering Models by L Goldstein and W H Lane; Some Calculations on Proton Proton Scattering by J D Jackson and J M Blatt; Water Drop Model of Radioactive Alpha-Decay by B T Darling and J E Garvey; Calculation of Interaction Integrals in Wigner's Theory of Heavy Nuclei by David H Frisch; Application of Charge-Symmetrical Nuclear Forces to Wigner's Theory of Heavy Nuclei by V F Weisskopf and David H Frisch; Spins, Moments, and Shells in Nuclei by L W Nordheim; Classification of Isomeric Transitions by P Axel and S M Dancoff, Determination of Absolute Neutron Intensities by Roger W Paine Jr, John E Dacey and Clark Goodman, Nuclear Shielding Studies by John E Dacey, Roger W Paine Jr and Clark Goodman; Shielding Measurements in Concrete by Victor Delano and Clark Goodman; Photographic Neutron Detector of High Sensitivity by Thomas H Johnson; Total Cross Sections of Small Samples of Hf, Er, Ni^{58} and Ni^{60} from Neutron Crystal Spectrometer Measurements by S Bernstein, J B Dial, C P Stanford and T E Stephenson; On the Absorption of Slow Neutrons by He_3 Nuclei by L D P King and Louis Goldstein; On the Interpretation of Neutron Inelastic Scattering Data by Bernard T Feld; Spin-Dependent Neutron Scattering by Various Nuclei by C G Shull and E O Wollan; Coincidence Measurement of Neutron Energies by D C Worth; Efficiency of the Electrolytic Separation of Nitrogen Isotopes by Dwight A Hutchison; Precision Measurement of the Wave-Length and Spectral Profile of the Annihilation Radiation from Cu^{64} with the Two-Meter Focusing Curved Crystal Spectrometer by Jesse W M DuMond, David A Lind and Bernard B Watson; Symmetrical Meson Theory of Nuclear Forces by T Y Wu and H M Foley; Correction to Nucleon Scattering from Virtual Meson Emission by Ning Hu; The Interaction of Photon, Meson, and Nucleon Fields by George J Yevick; Equivalence Theorems for Meson-Nucleon Coupling by K M Case; On the Interaction of a Nucleon with a Pseudoscalar Meson Field by Herbert Goldstein and Herman Feshbach; On the Coupling of μ-mesons with Nucleons by J Tiomno and John A Wheeler; On the Spin of π- and μ-Mesons by John A Wheeler and J Tiomno; The Absorption of Negative Pi-Mesons in Hydrogen by A S Wightman, R E Marshak, and J A Wheeler; Production of π-Mesons in Nucleon-Nucleon Collisions by L L Foldy and R E Marshak; The Performance of a Light Scattering Photometer for Determining High Molecular Weights by B A Brice; Evidence of Low Energy Gamma-Rays (1-5 Mev) from Stopped Negative Mesons by W Y Chang; On the Range of the Decay Electrons of Cosmic-Ray Mesons by J Steinberger, The Disintegration of Mesons by R W Thompson; Nature of the Primary Cosmic Radiation as Revealed by Transition Effects in Lead and within the Atmosphere by J A Van Allen, L W Fraser and R S Ostrander; Heavily Ionizing Radiation at a 4300-Meter Altitude by Frank L Hereford; The Detection of Heavy Particles in the Primary Cosmic Radiation by Martin A Pomerantz and Frank L Hereford; Directional Intensity of Cosmic Rays at High Altitudes. I Instrumentation by W G Stroud, J R Winckler and J Schenck, and II. Interpretation by J R Winckler and W G Stroud; The Latitude Effect at High Latitudes and High Altitudes by W F G Swann, Peter A Morris and David Seymour; Influence on the Cosmic-Ray Spectrum of Five Heavenly Bodies by T J B Shanley, E O Kane, J A Wheeler; Detection of Cosmic-Ray Particles by Scintillation Counters by George T Reynolds; An Alternative Subtraction Formalism for Quantum Electrodynamics by T A Welton; The Theory of Positrons by R P Feynman; On Exact Solutions of the Dirac Equations by A H Taub; Relativistic Theory of Radiation Scattering by Otto Halpern and Harvey Hall; A New Approximation Method in Scattering

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Phase Calculations by H Ekstein; An Approach to Perturbation Theory by the Variation Iteration Method by W Kohn; Interaction by Boundary Conditions by M Moshinsky and E P Wigner; Shift of the $2^2S_{\frac{1}{2}}$ State in Hydrogen and Deuterium by R C Retherford and W E Lamb Jr; Nuclear Moments of B^{10} and B^{11} by Walter Gordy, Harold Ring and A B Burg; Magnetic Resonance Frequencies for Several Nuclei by F Bitter; Fine Structrue of the Proton Magnetic Resonance in $CuSO_4 \cdot 5H_2O$ by N Bloembergen; Pulse Method for Nuclear Magnetic Resonance by Henry C Torrey; A New Molecular Beam Magnetic Resonance Method by Norman F Ramsey; The Magnetic Moment of the Proton by H Taub and P Kusch; Direct Photometry on Tracks in the Photographic Emulsion by Pierre Demers and Roger Mathieu; A Photographic Emulsion Method of Measuring Relative Fission Cross Sections by Maurice M Shapiro; Sensitivity of Physically Developed Nuclear Emulsion Tracks to Specific Ionization by N W Curtis and L S Osborne; Grain Density in Nuclear Tracks by M Blau; The Statistical Distribution of Arc-Chord Differences in Scattered Particle Tracks by W T Scott; Calibration of Photographic Emulsions for Low Energy Electrons by L Cranberg and J Halpern; On the Star-Producing Radiation and the Absorption of the Nucleonic Component by G Bernardini; Studies of Cosmic-Ray Phenomena in Nuclear Research Emulsions by Adair Morrison and Eric Pickup; Some Cosmic Ray Events in Photographic Emulsions by Eric Pickup and Adair Morrison; Lithium Borate-Loaded Emulsions as Neutron Detectors by Herman Yagoda and Nathan Kaplan; A Counter Controlled High Pressure Cloud Chamber by G E Valley and J A Vitale; High Altitude High Pressure Cloud-Chamber Pictures by C P Leavitt, G E Valley and J A Vitale; Nuclear Explosions in Photographic Emulsions Produced by Primary Cosmic Rays by M F Kaplon, B Peters and H L Bradt; Theoretical Remarks on Nuclear Disruptions by Primary Cosmic Rays by S A Wouthuysen; Some Cloud Chamber Photographs Obtained with a High Pressure Cloud Chamber by R P Shutt, G R Hoke, W A Tuttle and G F O'Neill; Observations at Sea Level with a Self-Controlled Cloud Chamber by Martin J Cohen; Ionization Bursts as a Function of Chamber Area by C G Montgomery and D D Montgomery; Narrow Air Showers by John Pao-ngo Wei; Cloud-Chamber Observations of Penetrating Showers in Lead at 3020 Meters by William B Fretter; Formation of Metastable H Atoms by Electron Bombardment of H_2 by W E Lamb Jr and R C Retherford; Separation of Argon 36 by Thermal Diffusion by James O Buchanan; He^3 and the Origin of Terrestrial Helium by P Morrison and D B Beard; Remarks on the Evolution of the Expanding Universe by R A Alpher and R C Herman; On the Positive Excess of the Penetrating Component in Cosmic Rays by G Bernardini; The Properties at Very High Altitudes of Cosmic Radiation at Large Zenith Angles, and Verification of a Consequence of Liouville's Theorem by Martin A Pomerantz; Quantum Electrodynamics by Frederik J Belinfante; A Covariant Hamiltonian Formulation of Field Theory and the Transformation to the Interaction Representation by Norman M Kroll; On the Interaction of Charged Spin O Particles with the Electromagnetic Field by A Pais and G E Uhlenbeck; On the Delayed Neutron Emitter $_7N^{17}$ by K H Sun, B Jennings, W E Shoupp and A Allen.

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2167 Delayed Emission of Electrons from the Cathode in a Counter When Operated above the Plateau by M L Wiedenbeck and H R Crane Phys Rev 75 1268 (1949) Apr 15 (Letter to the editor)

The results of previous experiments [(Phys Rev 75 985 (1949)] on the discharge in the conventional Geiger-Müller counter tube in the voltage range above the plateau, which suggested that any given discharge was initiated by an after-emission of electrons or photons excited by the previous discharge, have been extended to determine whether the cathode, anode, or gas is mainly responsible for the after-emission. The specially constructed counter used has a sliding cathode which permitted measurements with cathodes of aluminum, lead and brass. The decay curves thus obtained, which are shown, differ markedly and it is concluded that the delayed counting is predominantly due to the cathode surface. It is suggested that when a Geiger counter is subjected to voltages above its plateau the rapid succession of spurious counts produced is initiated by the delayed emission of electrons from the cathode, excited by the preceding count.

2168 An Improved Quench Circuit for Geiger Counters by E H Cooke-Yarborough, C D Florida and C N Davey J Sci Instruments 26 124-125 (1949) Apr

A quench circuit is described which has been designed to improve the characteristics of Geiger counters containing a quenching vapor. The improved sensitivity to small pulses, constancy of dead time and stability are effected by suppressing spurious counts, thereby giving a flatter plateau, and by providing a known constant dead time, thus permitting an accurate estimate of the counting losses to be made.

2169 Inappreciable Effect of Compton Shifted Scattering, within a Gamma-Ray Source, on Precision Wave-Length Determinations with the Focusing Crystal Spectrometer by Jesse W M DuMond Phys Rev 75 1266 (1949) Apr 15 (Letter to the editor)

A correction for the distortion in line shape of lines obtained with the present 2-meter focusing curved crystal spectrometer [(Rev Sci Instruments 18 626 (1947)] due to Compton shifted scattering within a gamma-ray source is evaluated by means of the Klein-Nishina formula. It is found that this correction is negligible when it is applied to recent precision measurements of the annihilation wave length from recombination of β^+ and β^- in a neutron activated block of copper [(Phys Rev 75 1226 (1949)].

2170 Methylene Bromide as a Quenching Agent in Geiger-Müller Counters by J H Carver and G K White Nature 163 526-527 (1949) Apr 2 (Letter to the editor)

Measurements have been made of the β-counting rate of Geiger-Müller counters filled with methylene bromide and argon; such counters are self-quenching and possess long sloping plateaux. Two counters A and B of identical construction were used for these measurements, A containing argon at a pressure of 97 mm of mercury and ethyl alcohol at a pressure of 9.7 mm of mercury, and B containing argon at a pressure of 74 mm of mercury and methylene bromide at a pressure of 7.4 mm of mercury. The efficiency of counter B was greatest for particles entering the counter near the center wire, but even then was less than that of counter A by a factor of about three. The observed lower efficiency of counter B has been attributed to the formation, by attachment, of negative ions in methylene bromide. An expression for the coefficient of electron attachment is given which has been used to calculate α/p as a function of Z/p, where p is the partial pressure (in mm of Hg) of the methylene bromide in the counter, Z is the field strength in volts/cm, and α is the coefficient of electron attachment. The results obtained (which are not given) are of the same order of magnitude as those obtained for bromine by the diffusion method [(Bailey, Makinson, and Somerville, Phil Mag 24 177 (1947)], supporting the authors' hypothesis.

2171 Microscopes for the Examination of Nuclear Research Emulsions by D N F Dunbar and J C Bower J Sci Instruments 26 132-133 (1949) Apr (Letter to the editor)

An automatic scanning microscope and a precision measurement microscope have been constructed to be used in studying nuclear research emulsions. Schematic diagrams of the two instruments are shown.

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

It is noted that the scanning microscope scans in a series of steps rather than with a continuous movement, as this has been found to be more efficient. It is claimed that the scanning rate as compared with ordinary microscopes can be doubled by using this instrument, without loss of efficiency. In the case of the measuring microscope also, high efficiency has been obtained, since it was found that in the measurement of projected tracks by several observers less than 1.5 per cent of the readings differ from the mean value by more than 1 μ, whereas about 80 per cent of the readings were consistent to within 0.5 μ or better. The coordinates used can be determined to better than 0.0001 in.

2172 On the Mechanism of the Fading in Photoemulsions Used for Nuclear Research (Sur le mecanisme du fading des plaques pour recherches nucléaires) by Georgette Albouy and Henriette Faraggi Compt Rend 228 68-70 (1949) Jan 3 (In French)

A study was made of the influence of different factors on the fading of track images in photographic emulsions. The role of the temperature can be expressed by $1/t \sim e^{-k/T}$ (t is the time required for a certain relative amount of grain images to fade, k is a constant, T is the absolute temperature). The influence of the humidity is weak up to 50%; it increases rapidly above 70%; it seems to be an exponential function of the quantity of water absorbed by the gelatin. Salts present in the emulsion accelerate the fading if they tend to diminish the pH of the emulsion (acetates, nitrates); the opposite is true of salts that increase the pH (borax, sodium carbonate). Oxygen accelerates the fading very rapidly. Yagoda (Nucleonics 2 (1948) May) has shown the strong accelerating action of H_2O_2, and has suggested that the phenomenon of fading is due to formation of H_2O_2 by particles passing through the gelatin. This view is opposed by the present authors. The quantity of H_2O_2 thus formed is found inadequate to account for the phenomenon. The authors explain the fading by a simple mechanism of oxidation $2Ag + O + H_2O = 2Ag^+ + 2OH^-$. They show that their view is corroborated by all the findings concerning the influence of various factors on the fading.

2173 On the Use of Coincidence Amplifiers with a Low Resolving Power (Sur l'utilisation des amplificateurs à coincidences ayant un temps de résolution faible) by René Cohen J Phys et Radium 9 256-258 (1948) Oct (In French)

Having to work with an amplifier whose resolving power (2.2×10^{-7} sec) was of the same order of magnitude as the lag in the counters, the author made a study of the working conditions of the set up. The numbers of coincidences N from two Geiger-Müller β-counters (4 cm long, 0.1 mm Al walls, 0.07 mm Mo wire, filling 9 cm A + 1 cm alcohol) were determined for various values of the potential differences V_1 and V_2 in the counters. When V_1 was plotted against V_2, and points of equal N joined, a promontory-like picture resulted, showing a plateau of maximal N. It followed from the discussion of this picture that the effect of an increase of the potential difference in a counter may be equivalent to a reduction in the circuit's lag. These findings agree with those of Sherwin [(Rev Sci Instruments 19 111 (1948)] who used a different method. In concluding, the author thinks that, when working with counters of the type described above, it is advisable to use an amplifier with a resolving power not exceeding 0.5 to 1×10^{-6} sec; only in cases where the relative number of random coincidences is large, there is an advantage in using higher resolving powers.

2174 Procedure for Processing Nuclear-Track Emulsions by M J Wilson and W Vanselow Phys Rev 75 1144-1146 (1949) Apr 15

Procedures have been investigated for processing exposed Eastman NTB Nuclear Track Plates which have thicknesses in the range of 100-175 μ and 200-260 μ. Processing recommendations are given for developing essentially all tracks of ionizing particles, including electron tracks. The process consists in initiating development at a low temperature and allowing it to go to completion at a higher temperature, checking development in a cold acid stop bath, and fixing (with nitrogen agitation) first at a low and later at a higher temperature.

2175 Properties of the α-Particle Spark Counter by R D Connor Nature 163 540-541 (1949) Apr 2

A preliminary account of investigations of the properties of the Rosenblum-type spark counter [(Phys Rev 67 222 (1945)] for α-particles is given. Characteristic curves of the counting rate as a

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

function of the voltage between the cathode and ground are given for various counter positions for counters filled with air, oxygen, and argon + air at approximately atmospheric pressures. A corona is observed in the case of air, which is related to the long counting plateau observed.

2176 Resolving Power and Anisotropy of Proportional Counters by Sait Akpinar Revue de la Faculté des Sciences de l'Université 'd' Istanbul 13A 165-185 (1948)

The results obtained on the performance of air-filled and alcohol vapor-filled counter tubes over a wide voltage range are described. The alcohol vapor counters were found to possess a wider counting range and to exhibit greater anisotropy than the air-filled counters. It is noted that at about 900 v., anomalous behavior was observed in the case of the alcohol-vapor counters; this effect vanished at higher voltages.

2177 A Simple Method for Recording Changes of Radioactivity by G P Burn and E J Harris J Sci Instruments 26 126 (1949) Apr (Letter to the editor)

A method is described which is applicable to the recording of changes in radioactivity in physiological experiments in which a Geiger counter and decade scaling unit are used. If it is necessary to take readings at close intervals and a counting rate meter is not usable, the output pulses from the scaling unit, corresponding to completion of a given number of counts, can be used to operate a recording lever attached to a kymorgraph drum.

2178 A Study of the Possibilities Offered by an Annular Spectrograph Having Two Points of Focus for the Study of β-Rays by P Hubert J Recherches Centre Natl. Recherche Sci., Labs. Bellevue (Paris) 132-138 (1948)

A theoretical discussion is given of the possibility of using an annular β-ray spectrograph having two focal points. The dispersion, aberrations, and the photographic image produced by a theoretical point source and a real extended source are discussed. The superiority of such a spectrograph, having a $1/(r)^{\frac{1}{2}}$ field, over a spectrograph having a uniform field is noted; the former is particularly useful in the separation of closely associated rays. The cooling of coils and the stabilization of the current are simplified by the low energy requirements of this new instrument. One inconvenience noted, however, is the fact that low energy electrons come to focus in the coils in this instrument, making observations impossible in such cases.

2179 Thin Glass Counter Windows by J T Lloyd J Sci Instruments 26 126 (1949) Apr (Letter to the editor)

A method of making thin glass windows for counters is described. Using this method windows which will withstand an excess pressure of one atmosphere on the outer surface can be easily constructed in tubing of up to 3/4 in. diameter. Such windows are approximately 0.25 mg/sq.cm. thick.

PHYSICS, THEORETICAL

2180 Note on the Variational Method for Finding Extrapolated Endpoints by Henry Hurwitz Jr. AECD-2577 Sept 5 1947 Decl Apr 28 1949 4p Proposed for publication in Nucleonics

A procedure is given for obtaining the value for the extrapolated endpoint of a general Kernel using a constant trial function; it is similar to that used by Marshak in the case of the Milne kernel [Phy Rev 71 688 (1947)]. This procedure, when applied to a general kernel, leads to a simple formula for the extrapolated endpoint, which is of value in physical problems where the kernel is not known analytically; the formula indicates those properties of the kernel which are most important in determining the extrapolated endpoint.

2181 Divergences in Field Theory by K M Case Phys Rev 75 1440-1441 (1949) May 1 (Letter to the editor)

Theoretical investigations indicate that the mass and charge renormalization which have facilitated the removal of divergences in quantum electrodynamics do not completely encompass the divergences of other quantum field theories. It is noted that new developments would be required to enable the use of vector mesons as a supplement to the pseudoscalar theory.

PHYSICS, THEORETICAL (continued)

2182 The Generalized Schrödinger Equation in the Interaction Representation by P T Mathews Phys Rev 75 1270 (1949) Apr 15 (Letter to the editor)

The generalized Schrödinger equation, which has been used in the interaction representation for a system whose state is given on a space-like surface, has been deduced by a new method: when applied to a particular case this formulation will give the Hamiltonian directly, even when the interaction involves derivatives and the Hamiltonian consequently contains terms dependent upon the direction of the surface. The mathematical procedure involved is outlined briefly.

2183 On a New Equation of State by E M Corson Phys Rev 75 1264 (1949) Apr 15 (Letter to the editor)

A new equation of state describing many solids, compounds, and liquids has been obtained from very general principles of quantum mechanics and statistics, starting from a more precise analysis of the electron gas, and taking advantage of the fact that the zero-point pressures are generally very great compared to obtainably applied pressures. The equation derived is:

$$P = \pi_r - \pi_a = \beta \left(\frac{e^{\beta V_0/\lambda RT} - e^{\beta V/\lambda RT}}{e^{\beta V/\lambda RT} - 1} \right)$$

in which π_r denotes the repulsive electron gas pressure, π_a the attractive compensating internal pressure, V_0 the initial volume, β, the zero-point pressure, λ, the effective number of electrons (per atom in the monatomic case, for example), and other quantities having their usual significance. As expected, it has been verified that this equation does not apply to ionic crystals or to molecular solids. In addition, agreement within 0.5 percent has been obtained with the data of Bridgman and similar excellent agreement has been found for the change in relative resistivity under pressure. A paper giving the detailed theory and comparison of calculated and observed compressibilities, resistivities, and specific heats will be published shortly.

2184 On Problems Involving Permutation Degeneracy by E M Corson Phys Rev 75 1266-1267 (1949) Apr 15 (Letter to the editor)

The mathematics of an alternative inductive, or symbolic method for the calculation of energies for electron problems, which yields all physically significant representations by elementary algebra and matrix multiplication, is described. It is noted that this method facilitates factorization of the secular equation in problems which afford additional (space) symmetry elements.

2185 On the Magnetic Moments of the Nucleons in Meson Theory by J M Luttinger Phys Rev 75 1277-1278 (1949) Apr 15 (Letter to the editor)

The method given previously [(Phys Rev 74 893 (1948); Helv Phys Acta 21 483 (1948)] for the calculation of the magnetic moments of the neutron and proton in the pseudoscalar meson theory has now been applied to one version of the vector meson theory. The coupling used is that in which the meson field four-vector is directly coupled to the current four-vector of the nucleon field and gives convergent results to terms in the square of the coupling constant, for all quantities considered. Expressions for the interaction energy density of the meson and the nucleon fields in the presence of an external static magnetic field are given for neutral mesons and charged mesons. To obtain the necessary solution of the vector meson equations in the presence of an external homogeneous field the equations of Snyder and Weinberg [Phys Rev 57 307 (1940)] must be solved. Using these solutions, the expressions for the magnetic moments of the neutron and proton for the neutral and charged theories have been obtained. The coupling constants were chosen so that simple addition gives the results for the "charge symmetric" theory. The results indicate that this type of coupling alone cannot give agreement with the experimental results. The possibility that such an agreement might be obtained by means of a "mixture" theory involving pseudoscalar and vector mesons, is suggested. The following values for the dimensionless coupling constants of the vector and pseudoscalar theories are necessary to give agreement with experiment: (1) if the vector mesons are given mass $1000m_e$ and the pseudoscalar mesons are assigned mass $300m_e$ (approx.), $g_{ps}^2 \sim 8$, $g_v^2 \sim 8$; (2) if the masses are reversed, $g_{ps}^2 \sim 11$ and $g_v^2 \sim 6$.

PHYSICS, THEORETICAL (continued)

2186 On the Sturm-Liouville Problem Connected with a Continuous Spectrum by Lamek Hulthén Arkiv Mat Astron Fysik 35 A Paper No. 25 (1948) Sept 21 14p

It is shown that the variational problem which has been previously formulated by the author [Kgl Fysiograf Sällskap Lund Förh 14 Paper No. 21 (1944)] can be reformulated in a manner which is more closely adapted to the familiar methods of the calculus of variations and which at the same time brings out the quasi-eigenvalue character of the asymptotic phase more clearly. The practical advantages of the new method are illustrated by means of an example in which it is applied to a potential function of the Yukawa type. The new method is compared with the earlier method and found to have the following advantages: (1) simplification of calculations by eliminating the necessity of using successive approximations, and (2) the determination of the eigenphase with the same accuracy, allowing a more direct estimate of the order of magnitude of the error involved. A generalization which is valid when the Coulomb potential is included in the interaction is given in an appendix. Approximate solutions of the differential equations for the example (Yukawa-type potential function) are given in tabular form in a second appendix.

2187 On the Vector and Pseudovector Theories of Nuclear Forces by Gentaro Araki Phys Rev 75 1262 (1949) Apr 15 (Letter to the editor)

Expressions for the non-relativistic, two nucleon potential in the vector and pseudovector theory have been obtained as follows: 1) in the vector theory

$$W = \left\{ G^2 + g^2 \sigma_1 \sigma_2 + g^2 \left(\frac{2M}{-\mu} \right)^2 \rho_2(1) \rho_2(2) \right\} \frac{e^{-kr}}{r} T,$$

and 2) in the pseudovector theory

$$W = \left\{ - f^2 \sigma_1 \sigma_2 - (f^2 - g^2) \left(\frac{2M}{\mu} \right)^2 \rho_2(1) \rho_2(2) \right\} \frac{e^{-kr}}{r} T,$$

where G, g, and f are the constants of the vector, six-vector, and pseudovector interactions, and T is $(\tau_1^{(1)}\tau_1^{(2)} + \tau_2^{(1)}\tau_2^{(2)})/2$ (charged theory or $\tau_1\tau_2/2$ (symmetrical theory). As was shown in the previous letter, [Adel and Slipher, Phys Rev 47 651 (1935)] they are equivalent to the hitherto well-known potentials in case of large r, but different from the latter in case of small r and are free from a r^{-3} term having only a r^{-1} singularity.

2188 Phenomenological Quantum Electrodynamics. Part III. Dispersion by K M Watson and J M Jauch Phys Rev 75 1249-1261 (1949) Apr 15

The quantum theory of a radiation field in an infinite dielectric medium is extended to include dispersion. The Cerenkov radiation is discussed in terms of the theory both for the case in which the medium is at rest and the electron moving and for the case in which the electron is at rest and the medium moving. In each case the results obtained agree closely with those of the corresponding classical treatment.

2189 The Quantum-Mechanical Problem of a Particle in Two Adjacent Potential Minima I. Direct Solution by D S Carter and G M Volkoff Amer J Phys 17 187-195 (1949) Apr

A direct solution is given of the quantum-mechanical problem (which has an exact solution) of a particle in two adjacent potential minima or "wells." After the exact solution is obtained in implicit form, the perturbation theory is applied and the eigenfunctions of interest are obtained. Specializations of the problem for the following cases are given: 1) two wells far apart; 2) a single well; and 3) two wells, one of which is shallow. The solution of this problem is believed to be of pedagogical help to the student being introduced to the applications of perturbation theory in quantum mechanics, since such an exact solution can be used for a step-by-step check of the approximations found by perturbation theory.

PHYSICS, THEORETICAL (continued)

2190 Radiative Corrections to the Klein-Nishina-Formula by R Schafroth Phys Rev 75 1111-1112 (1949) Apr 1 (Letter to the editor)

The newly developed methods of quantum electrodynamics have been applied to the scattering of light by a charged particle of spin 1/2. Owing to their lengthy nature, the formulas obtained will be published in a later paper. It is noted that uniqueness difficulties of the type previously noted for the Lamb-Retherford shift and the anomolous magnetic moment of the electron have been encountered. For the non-relativistic case the following correction for the differential cross section is obtained:

$$d\sigma_6 = (r_0^2/137)\,(d\Omega/4\pi)\,(k/m)^2\,\{[1+\cos^2\vartheta]\,[2\log(k/m)+(8/3)\log(\omega/m)] - (8/3)$$

$$[1+\cos^2\vartheta]\cos\vartheta\log(\omega/m) - (4/3)\,[1-\cos^2\vartheta]\cos\vartheta\log(k/m)\},$$

where k is the momentum of the photon, m the mass of the electron, r_0 the classical electron radius, ϑ the scattering angle, $d\Omega$ the solid angle element, and ω the cut-off radius of the double Compton effect. Thus $d\sigma_6$ is the cross section for a process in which, in addition to the scattered photon (ϑ), at most one of momentum $\leq \omega$ is emitted.

2191 Vacuum Polarization by S T Ma Phys Rev 75 1264-1265 (1949) Apr 15 (Letter to the editor)

The integral obtained by Schwinger (Lecture Notes, University of Michigan, 1948) for the induced charge-current density due to the polarization of the vacuum by an electromagnetic field has been evaluated along the lines of the customary calculations in radiation problems. A finite, Lorentz- and gauge-invariant result is obtained. It is noted that the two divergent terms in the resulting equation are those recently obtained by Tomonaga, Koba, and Takeda [Prog Theor Phys (in press)] from a detailed analysis of the effect of vacuum polarization in radiative processes and which were subtracted by these authors from the Hamiltonian in order to obtain finite results.

2192 Wave Mechanics and its Applications by N F Mott and I N Sneddon. Oxford, Clarendon Press 1948 xii + 393 p

The applications of quantum mechanics, rather than with its foundations or development, provide the substance of this treatise. Approximately half of the material presented is concerned with simple illustrations of wave mechanics and applications to the electronic structure of atoms; this includes discussion of the WKB (phase-integral) method, perturbation and variations methods, electron spin, and the Hartree and Fock methods. The remaining half contains material on interatomic forces and valence, the theory of solids, collisions problems, radiation theory and relativistic quantum theory; a wide variety of information on information on physical problems is included here also. In the concluding chapter, the ideas of matrix mechanics and of transformation theory are discussed briefly. References to the periodical literature and to treatises are included.

RADIATION SICKNESS

2193 Studies on the Toxicity and Anti-Heparin Action of Protamine in the Goat by William J Rashkind. Naval Medical Research Institute Report No. 7 Mar 26 1948 10p (NP-760)

The toxicity and anti-heparin action of protamine is presented as a study preliminary to the testing of the drug as a therapeutic agent for the hemorrhagic diathesis of actute radiation illness. The drug has an average therapeutic index of 4-5 in goats. The anti-coagulant action of protamine is due largely to its antithrombic action. Heparin is rapidly neutralized by protamine injected intravenously in the goat.

RADIOACTIVITY

2194 A New Isotope of Protactinium - Pa^{229} by Earl K Hyde, Martin H Studier, Horace H Hopkins and Albert Ghiorso. AECD-2578 Sept 5 1946 Decl Apr 29 1949 6p For publication in NNES

A new isotope of element 91, Pa^{229}, has been produced by the nuclear reaction $Th^{230}(d,3n)Pa^{229}$. This isotope emits alpha particles of ~ 5.4 Mev energy with an apparent half life of 1.4 ± 0.4 days. It is believed that Pa^{229} decays principally by orbital-electron capture, but the x-rays were not detected because of conflicting activities.

2195 Half-Life of Tritium by R W Spence. AECD-2585 May 13 1947 Decl May 12 1949 11p (See also MDDC-1229)

The half-life of tritium was measured by observing the decrease with time of the ion current from an ion chamber containing tritium. The preliminary value of the half-life obtained is 10.7 ± 1.0 years.

2196 Branching Ratio in Be^7 Decay by C M Turner. AECU-211 Mar 17 1949 3p

Be^7 decays to Li^7 by orbital electron capture, with most of the decays being due to transitions directly to the ground state of Li^7, but with a small fraction going to the 475-Kev level of Li^7 and then to the ground state by emission of a gamma ray. The branching ratio, the fraction of decays that are accompanied by a gamma ray, may be represented by R. A measurement of R is being made based on the following method. The proton beam from the Van de Graaff electrostatic generator is used to produce samples of Be^7 and C^{11} by means of the $Li^7(p,n)Be^7$ and $B^{11}(p,n)C^{11}$ reactions. The Li^7 and B^{11} targets are surrounded during bombardments by a manganese bath which absorbs the neutrons emitted. From the observed counting rates and disintegration constants for Be^7 and C^{11}, and the neutron induced activities in the manganese bath a formula is derived for calculating R. Preliminary results indicate $.10 < R < .13$.

2197 Alpha-Radioactivity in Elements Lighter than Bismuth by N E Ballou Phys Rev 75 1105 (1949) Apr 1 (Letter to the editor)

An examination has been made of the possibility of the existence of α-emitting nuclides of elements of atomic number lower than bismuth. From the liquid-drop model of the nucleus and the effects of closed shells in nuclei, the possibility of α-emission competing with β-emission would be expected to be greatest for those isotopes on the light side of stability, the most favorable case being that in which the energy for β-disintegration is zero or very small. It is postulated that α-disintegration may be the important mode of decay, if such a nuclide of low β-disintegration energy differs in composition from that of a closed shell nuclide by an α-particle. Kohman's data on the stability of nuclei [Phys Rev 73 16 (1948)] are discussed from this viewpoint with particular reference to Ti^{44}, Sm^{146}, $_{61}^{145}$, Zr^{88}, and some isotopes of samarium.

2198 Application of Gamow's Theory of α-Emission to (4n + 1) Radioactive Series by Sukumar Biswas and A P Patro Indian J Phys 22 539-546 (1948) Dec

Gamow's theory of α-emission [Structure of Atomic Nuclei and Nuclear Transformations, (Clarendon Press, Oxford) p. 104 (1937)] has been applied to the neptunium (4n + 1) series. The values of the assumed "nuclear radius" r_0 are found to vary irregularly as in the actinium, (4n + 3) series. A large drop in r_0 occurs in $_{83}Bi^{213}$ similar to the C-products of the U, Th and Ac series. A complete calculation of r_0 values for all the members of the U, Th and Ac series is included with their extension to the transuranic region using the latest experimental values. It is noted that the existing theories of α-emission with angular momentum are inadequate in explaining these irregular variations of r_0 especially in the odd radioactive series. It appears that the nuclear charge Z is connected with the irregularities in r_0.

RADIOACTIVITY (continued)

2199 The Beta-Spectrum of A^{41} by H Brown and V Perez-Mendez Phys Rev 75 1276-1277 (1949) Apr 15 (Letter to the editor)

A β-ray spectrometer of the semicircular focusing type has been constructed for the investigation of the spectra of radioactive gases. Using a gas-flow probe [Bull Amer Phys Soc 24, No. 1, 12 (1949)] spectroscopically pure argon was bombarded by 8 Mev deuteron beams of about 15-25 microamps. for 40-50 minutes to produce A^{41} by a (d,p) reaction (other activities were negligible). A Kurie plot obtained, using a monitor counter in conjunction with the spectrometer (which gave a resolution of about 2.5 percent), is shown. The spectrum obtained seems to correspond to the allowed form in the Fermi theory and gives an extrapolated end-point of 1245 $\pm$ 10 Kev. An $f \cdot t$ value of 1.26×10^5 was obtained, putting A^{41} into the allowed class.

2200 Disintegration of Cs^{137} by Charles L Peacock and Allan C G Mitchell Phys Rev 75 1272-1274 (1949) Apr 15 (Letter to the editor)

The β-ray spectrum of Cs^{137} has been measured using a 180-degree type magnetic spectrometer of about 1% resolving power. A this Zapon-windowed Geiger-Müller counter which will detect electrons of 3 Kev and higher energies was used. The spectrum was found to consist of two groups - the main group having an energy of 0.521 Mev and a relative abundance of 95% and a much weaker group having an energy of approximately 1.2 Mev and a relative abundance of 5%. Fermi plots of both groups are shown. The shape of the plot for the low-energy group does not indicate an allowed transition since it is distinctly concave toward the energy axis. Although such a plot has been predicted this is the first time such a shape has been obtained empirically. The theoretical implications of the results obtained in attempting to fit various shape factors, as given by Uhlenbeck and Konopinski [Phys Rev 60 308 (1941); Revs Modern Physics 15 209 (1943)], to the data are discussed.

2201 Erratum: Disintegration of Be^8 by Arthur Hemmendinger Phys Rev 75 1267 (1949) Apr 15 (Letter to the editor)

The disintegration energy of Be^8 as reported in a previous article [Phys Rev 73 806 (1948)] has been corrected by considering also the momentum imparted to the excited Be^9 nucleus by the 2.62 Mev photon. A value of 103 $\pm$ 10 Kev is obtained which is in better agreement with the value of 84.5 $\pm$ 10 Kev quoted by Tollestrup, Lauritsen, and Fowler [Bull Amer Phys Soc 24 No. 2 E6 (1949)].

2202 Gamma-Rays from Na^{24} and V^{48} by J Eugene Robinson, Michel Ter-Pogossian and C Sharp Cook Phys Rev 75 1099 (1949) Apr 1 (Letter to the editor)

In connection with some other investigations, the gamma-radiations from Na^{24} and V^{48} have been measured on a 14-cm radius of curvature semicircular beta-ray spectrometer. [Phys Rev 74 677 (1948)]. The K and L lines of all gamma-rays were found distinctly visible and energies of 1.380 Mev and 2.765 Mev were obtained from measurements on the Klines. The gamma-ray energies obtained from the K lines are in good agreement with previously reported values.

2203 On the β-Radiation from Mesothorium I and from Mesothorium II (Sur le rayonnement β du mésothorium I et du mésothorium II) by Marcel Lecoin, Marguerite Perey and Jean Teillac J Phys et Radium 10 33-41 (1949) Feb (In French)

Since earlier data on the B-radiation of M Th_1 (mesothorium I) are incomplete and contradictory, further studies have been made using a Wilson cloud chamber. The choice of the initial product of M Th_1 and the chemical purification processes used resulted in M Th_1 giving 0.8 disintegrations to 100 from radium and less than 0.5 to 100 from Th X. Using a Wilson cloud chamber with a pressure varying from atmospheric pressure to 10 cm of Hg the following results were obtained: 1) the β-spectrum of M Th_2 consists of two components which are almost of equal intensity and which end at approximately 60 Kev. The total number of β-rays from the disintegration of M Th_2 is about 2. The radiations of the two components are not emitted simultaneously. 2) The disintegration of M Th_2 is accompanied by the emission of a band of β-rays of feeble intensity, i.e., 15 electrons for 100 disintegrations. The energy of these rays varies between 1.5 and 18 Kev. The spectrum seems to indicate the presence of two or three rays of 3.7 and perhaps 12 Kev, implying that these rays are of secondary origin.

RADIOACTIVITY (continued)

2204 On the Disintegration of Br^{80} Isomers by S D Chatterjee and N K Saha Indian J Phys 22 515-530 (1948) Dec

The nuclear isomerism of Br^{80} has been quantitatively studied and β-ray end-points of the isomers have been obtained by the absorption method of Widdowson and Champion [Proc Phys Soc 50 185 (1938)]. Using neutrons of thermal energy, the end-points of both the isomers were found to be the same, i.e., 2.02 Mev. If fast neutrons from an (Ra + Be) source are used for irradiation, the end-point of the 4.4 hr. isomer remains at 2.02 Mev, while that of the 18 mins. isomer shifts to 2.26 Mev. Furthermore the excitation ratio of the activity of 18 mins. to that of 4.4 hr. has been studied as a function of the excitation energy of the bromine nucleus as obtained by the bombardment of bromine by slow neutrons, fast neutrons, and a mixture of fast and slow neutrons. The excitation ratio in the three cases is found to be 2.1, 2.69 and 2.3 respectively. In order to explain these observations an energy level scheme of the Br^{80} and Kr^{80} nuclei has been suggested. According to this, a metastable state of $\sim$48 Kev and an excited state of $\sim$0.2 Mev above the ground state are attributed to the Br^{80} nucleus, while an excited state of $\sim$0.5 Mev above the ground level of Kr^{80} appears to fit well with γ-radiation of this energy which has been previously observed.

2205 On the Gamma-Radiation from I^{131} by David Moe, George E Owen and C Sharp Cook Phys Rev 75 1270-1271 (1949) Apr 15 (Letter to the editor)

The γ-spectrum from I^{131} has been studied by determining the spectrum of the photo- and Compton-electrons ejected from a 50 mg/cm^2 uranium radiator. It is noted that, although the K and L lines of the strong 364.18-Kev γ-rays predominate, the K line of the 284.1 Kev γ-ray and the K- and L-lines of the 638 Kev γ-ray are also easily observable. Two low intensity lines were observed, too, at 1080 gauss-cm and 1380 gauss-cm which have been assigned to 208-Kev and 159-Kev γ-rays, respectively.

2206 On the Problem of the Relationship between the Disintegration Energy and the Nuclear Structure of α-Emitters (Zur Frage des Zusammenhangs zwischen Zerfallsenergie und Kernbau bei den α-Strahlern) by Berta Karlik Acta Phys Aust 2 182-186 (1948) Sept (In German)

Early studies of relationships between disintegration energies and atomic or mass numbers of α-emitters were reviewed by Meyer [Wien Ber 141 71 (1932)]. More recently, Schintlmeister [Wiener Chemiker-Zeitung 46 106 (1943)] and Berthelot [J Phys et Radium 3 17 (1942)] plotted disintegration energies against mass numbers and joined points of equal atomic numbers, or points of equal neutron-proton differences. The curves obtained displayed regularities, such as parallel course and concording maxima. The present author included into these diagrams the recently discovered α-emitters in the region of the atomic numbers 83-96. The agreement with the experiment is in general very satisfactory. The position of the element 85^{217} is in accordance with certain predictions made by the author in a previous work [Z Physik 123 51 (1944)]. The fact that no radon isotope (Rn^{221}) was observed, so far, in the neptunium series can be explained by the position of Ra ^{225} in the diagram, which corresponds to a disintegration energy of 5.35 Mev or, according to the Geiger-Nutall rule, to a half life of 13.2 years; since Ra^{225} has a 14.8 day β-activity, a possible α-branching ratio has the small value 3.5 x 10^{-4}. Similar reasoning permits the prediction of an α-branching of $_{87}Fa^{223}$, with a ratio = 2 x 10^{-3}. The position of AcX in the diagram would call for a much higher disintegration energy than that experimentally known; the opposite is true of RaAc: it is known that these two nuclei present anomalies also in the application of the Geiger-Nutall rule. Surprising anomalies show the polonium isotopes 206, 207, and 208: the experimentally found values for their disintegration energies would cause the polonium curve to undergo a sudden bend. The recently determined disintegration energy of protactinium (5.06 Mev) fits into the diagram much better than the older value (5.3 Mev).

RADIOACTIVITY (continued)

2207 Precision Measurement of the Wave-Length and Spectral Profile of the Annihilation Radiation from Cu^{64} with the Two-Meter Focusing Curved Crystal Spectrometer by J W M DuMond, D A Lind, and B B Watson Phys Rev 75 1226-1239 (1949) Apr 15

The two-meter focusing curved crystal spectrometer has been used to make a direct precision wave-length measurement of the annihilation radiation from Cu^{64} by first-order reflection from both sides of the (310) planes of the curved quartz lamina. The instrument constant has been calibrated (by measurements of the K spectrum from a tungsten target X-ray tube) so as to give γ-ray wave-lengths correct to ± 0.01 x.u. Using a source of 2.5 curies of neutron-activated Cu^{64}, a sharp annihilation radiation line substantially symmetrical to within the precision of the observations was obtained. The measured wave-length at the peak of this line after conversion (by the multiplying factor $\lambda_s/\lambda_g = 1.00203$) from the conventional Siegbahn scale of x.u. to angstroms was 0.024271 ± 0.000010A which is in satisfactory agreement with the value 0.0242650 ± 0.0000025A obtained by DuMond and Cohen for the Compton wave-length [(Revs Modern Physics 20 106 (1948)].

The profile of the observed annihilation "line" is slightly broader than a careful analysis of all instrumental causes seems capable of accounting for. The residual "natural" profile, after abstraction of the instrumental broadening, is roughly estimated to have a half-width of 0.096 x.u. If this were ascribed to a Doppler effect of the motions of recombining pairs of moving negative and essentially stationary positive electrons the velocities would correspond to electrons of only 16 ev, an order of energy which can hardly be associated with anything but the conduction electrons in copper. The 0.66-Mev positrons emitted by the Cu^{64} nuclei are so rapidly retarded by large parameter inelastic "collisions" with electrons as Heitler has shown, that less than two per cent of them undergo annihilation before reaching thermal velocities. They then become virtually stationary targets for annihilation chiefly by conduction electrons and possibly M electrons. The repulsion of the nuclear fields probably explains why annihilation by K and L electrons is improbable.

2208 Radiation from 225-Day Ag^{110} by Kai Siegbahn Phys Rev 75 1277 (1949) Apr 15 (Letter to the editor)

An investigation of the radiation emitted from long-lived Ag^{110} has been performed using a large double-focusing spectrometer. The resolving power of the spectrograph was one per cent. The existence of a very complex gamma-spectrum was revealed, which is composed of at least 10 different gamma-lines. The energies of the gamma-lines were determined both from the internal conversion electron spectrum and the secondary photo electrons ejected from a 3.7 - μ thin lead converter. A table of the energy and intensity of the gamma-ray lines observed is given. The data indicate the existence of a metastable state of long life-time due to a high spin change (most probable 1 = 4). The analysis of the β-components indicates the presence of a very soft β-component with an upper limit of 87 Kev and an abundance of 58 per cent. Furthermore, one high energy component of very small intensity has been observed, having an end-point of small intensity has been observed, having an end-point of 2.79 Mev.

2209 Radioactive Gadolinium and Terbium Isotopes by F D S Butement Phys Rev 75 1276 (1949) Apr 15 (Letter to the editor)

Previous investigations of the activities produced by neutron activation of gadolinium [Krisberg and Pool, Phys Rev 74 44 (1948); Seren, et al. Phys Rev 72 888 (1947)] have been extended; the investigations have included a determination of σ by a pile activation method similar to that of Seren, et al. The results obtained for gadolinium oxide are summarized below:

			Radiation energy Mev	
Half-life	Element	σ (barns)	β	γ
218 ± 5 sec.	-	0.18	-	-
18.0 ± 0.2 hr.	Gd	1.1	0.95	0.055, 0.38
6.75 ± 0.1 d.	Tb	0.16	0.52	0.05 (no harder γ)

RADIOACTIVITY (continued)

The results suggest the following assignment:

$$Gd^{161} \xrightarrow[218\ sec.]{\beta} Tb^{161} \xrightarrow[6.75\ d.]{\beta} Dy^{161}\ stable.$$

The 18-hr activity has been assigned to Gd^{159}. Investigation of proton and deuteron-bombarded gadolinium showed that the 5.5 d. activity is actually a mixture of two activities having slightly different half-lives. One of these is ascribed to the aforementioned 6.75 d. Tb and the other has a half-life of about 5.9 d. The latter is probably a new Tb isotope, decaying by orbital electron capture, and having a mass number of 156-157-158.

RADIOTHERAPY

2210 Colloidal Lead Orthophosphate Associated with Deep Roentgen Therapy in Bone Metastases from Cancer of the Breast by Lawrence Reynolds, T Leucutia, James C Cook and Kenneth E Corrigan Amer J Roentgenol and Radium Therapy 60 193-205 (1948) Aug

The use of colloidal lead orthophosphate with X-radiations in the therapeutic treatment of bone metastases from breast carcinomas is described. Recent diffraction studies on rabbits confirm the affinity of the lead for the osseous system. Three hundred and fifty-five cases serve as the basis for determining the efficiency of this method. In 95% of these cases the immediate palliative effect was remarkable. The lead has a toxic action in itself, while there is a direct destructive effect from the standard roentgen irradiation. The 2 agents combine to form a third effect since the heavy lead atoms deposited withing the tumor area emit, under the influence of the roentgen irradiation, ionizing secondary electrons which also act on the carcinoma cells. Internal irradiation from radioactive lead orthophosphate has also been under investigation. It is concluded that the results warrant further studies. 11 figures 44 references.

2211 Effect of Intra-Uterine Radium Therapy on Ovarian Function by Gertrude Goldscheider Lancet 256 521-523 (1949) Mar 26

In an attempt to determine whether the amenorrhea produced by radiation is of ovarian or non-ovarian origin, the urinary excretion of follicle-stimulating hormones has been determined in 28 women before and after intra-uterine treatment with radium for menorrhagia. The results obtained were compared with those obtained for a few patients who had been castrated with X-rays or had received a combined treatment of X-rays and radium. The absence of an increase in follicle-stimulating hormone suggests that an artificial menopause has not been established and that the amenorrhea observed following radiation treatment was of non-ovarian origin. It is suggested that the destruction of the uterine glands could be the cause of the observed amenorrhea. Artificial menopause occurred only in women of menopausal age in whom small doses may influence ovarian function.

2212 High Voltage X-Rays in the Treatment of Malignant Tumors at a Depth by D W Smithers Annals of the Royal College of Surgeons of England 4 242-256 (1949) Apr

Radiotherapy and surgery, in combination, are successful in the treatment of deep-seated carcinomas. For relatively inaccessible sites, surgery is more advantageous alone. For cases of carcinoma of the breast or seminoma of the testicle, results are best when both are used. There is a steady diminution of dose at increasing depths, so that full r levels sometimes are not delivered by X-radiations. New high voltage machines deliver greater doses at a depth than on the surface. The maximum dose at 2-million volts is situated at a depth of 0.5 cm; at 20-million volts, 2 cm; at 50-million volts, 7 cm; at 100-million volts, 10 cm. Mortality statistics are given as well as rotation distribution curves and indications of future trends in deep-seated tumor therapy.

2213 Intra-Cavitary Contact Roentgen Therapy of Malignant Tumours by D den Hoed Acta Radiol 30 470-478 (1948)

A description is given of successful intra-cavitary contact roentgen therapy on a number of patients suffering from malignant tumors of the mouth, nose, pharynx, hypopharynx, larynx, bladder, rectum,

RADIOTHERAPY (continued)

vulva, vagina, and uterus. Doses of 1000 to 16000 r were administered during a period of from one to several days. Case histories, representative of the fields in which the therapy was used, are included. Results indicate the future possible use of this therapy for carcinomas of the cardia and glandular metastases in the neck, axilla, and groin. A warning is given against uncritical application of this new method.

2214 Methods of Application of Radioactive Isotopes in Anticancerous Researches (Modes d'application des Isotopes radio-actifs aux recherches anticancereuses) by G Joyet Schweiz Med Wochschr 78 708-710 (1948) July 24 (In French)

The treatment of cancer by radioactive isotopes is discussed with particular reference to the following two methods: (1) the introduction of such an isotope into the tissue, and (2) the production of a radioactive isotope from a stable isotope within the tissue by means of slow neutron bombardment. The criteria applied in selecting a suitable isotope and method are noted and a table of the emissions and half-lives of some of the most biologically useful radioactive isotopes is given. The differences between tissues with respect to sensitivity to particular types of radiations and affinity for particular isotopes is discussed; a combined treatment involving the use of X-rays in conjunction with 2 radioactive isotopes which utilizes differential tissue sensitivity is described. The applications of neutron-induced radioactivity are noted and data on stable isotopes which have large capture cross sections for slow neutrons are given in tabular form, since a tumor impregnated with an isotope of this kind can be treated by neutron bombardment. In a brief discussion by J. H. Müller the limited applicability of the aforementioned methods is noted, and a method which has been found particularly useful in the treatment of peritoneal cancer is described. In this method, a homogenous suspension of the radioactive isotope in a form which is chemically insoluble in the physiological medium is used Müller, [Experienta 1 6 (1945)].

2215 A New Method of Radiotherapy in the Treatment of Carcinoma of the Pharynx and the Larynx (Een Nieuwe Methode voor Radiotherapeutische Behandeling van Pharynex- en Larynxcarcinoom) by J De Backer Belgisch Tijdschrift voor Geneeskunde 4 696-706 (1948)

The new "directed beam" method of radiotherapy treatment is discussed with respect to principles and technique. It is noted that although the skin dose is not of importance in such treatment, the tumor dose is of importance, varying with the grade of sensitivity. The use of small fields is necessary in order to prevent skin damage with increasing dosage. However, errors in directing the small beams are more damaging with small fields than with larger fields, thus necessitating an exactly "directed" beam. The following sequence of steps is characteristic of this new method: (1) making a plaster mould, (2) determination of the site of the tumor with the help of roentgen rays, (3) determination of the relation between the center of the tumor and marks on the plaster cast, (4) fixation of the number of fields and the beam directions, (5) construction of fields (wax blocks) on the plaster mould, and (6) calculation of the dosage for each field using iso-dose curves. A brief survey of the indications for this therapy is included.

2216 Surgical Treatment of Radiation Burns by James Barrett Brown, Frank McDowell and Minot P Fryer Surg Gynecol and Obstet 88 609-622 (1949) May

The treatment by excision and grafting of burns due to excessive radiation on normal skin and regions with acne, eczema, and other abnormalities is described. Pathological effects of the radiation, such as loss of appendages of skin and obliteration of blood vessels, are noted, and specific treatment in these cases is detailed. The symptoms of severe burns are excessive pain, swelling, weeping skin, and possible sloughing of the epidermis. Treatment for this type of burn and for chronic improvement-resisting burns is, and should be, entirely surgical. Anatomical regions most commonly affected are described separately. In special cases immediate flap closure, delayed pedicle closure, or pedicle grafts are called for instead of the regular procedure. Surgery becomes necessary frequently to prevent the development of carcinoma in the affected areas.

2217 Thyroid Diseases by Earle M Chapman McGill Med J 18 71-87 (1949) Apr

The treatment of thyroid diseases by iodine, thiouracil, surgery, X-radiation, and internal radiation from I^{131} is outlined. The use of radiation therapy is traced from its beginning in 1901 to the present,

RADIOTHERAPY (continued)

and experiments to decide the definitive use of these agents are described. The use of radioactive iodine alone, the definition of single effective doses and their duration, the production of myxedema by a single dose, the observation of histologic changes in the thyroid before and after treatment and the observation of toxic effects of I^{131} are the points discussed and are answered in 4 tables. The average dose of I^{131} by mouth was 32.6 mc, and the average dose retained was 20.8 mc. Out of 100 patients treated for hyperthyroidism with I^{131}, 81 responded well. Evans found that the radiations needed to produce sarcoma are distinguished symptomatically by a delay of 10-20 years between the beginning of radiation and the recognition of malignancy and by a low level radiation dose maintained over a period of many years. Short-lived I^{131} does not seem to fit the requirements. All the above methods seem to be effective in treating hyperthyroidism. 39 references

2218 Treatment of Carcinoma of the Lip with High Voltage X-Ray by H B Ivey Southern Med J 41 685-688 (1948) Aug

The results of treatment in 109 cases of squamous cell carcinoma of the lip are given. The technique of treatment consists of using 5000-6000 r, at 200 KVP and 25 cm distance, through 2 mm copper and 1 mm aluminum or the equivalent filter. A round cone is used. The patient is given 300 r doses 4 or 5 days each week, a total of 1000-1200 r into the growth from the front and 2000-2500 r from each side, treating alternate sides on successive days. A strong reaction, which heals rapidly, develops. Only 5 cases out of 109 are failures. There are no irradiation complications from the therapy, such as scarring, trophic ulcers, or radio osteomyelitis.

2219 The Use of Radioactive Iodine in the Treatment of Graves' Disease by Myron Prinzmetal, Clarence M Agress, H C Bergman and Benjamin Simkin Calif Med 70 236-239 (1949) Apr

Radioactive iodine is discussed and summarized as a therapeutic agent in the treatment of Graves' disease. The report is based on the data compiled on 26 thyroid patients treated with I^{131}, the total dosage administered varying from 0.5 to 10 mc. The average recovery time was 3 to 4 months. Of the total number of patients treated, 25 became erythyroid. The techniques used, results, and the case histories of the patients are included in 2 diagrams. Complications included hypothyroidism and myexedema after treatment. The determination of the radioactive iodine uptake was indicated as a diagnostic procedure, since the amount of I^{131} in acute thyroiditis cases was found to be very low.

RARE EARTHS AND RARE EARTH COMPOUNDS

2220 Some New Neutron Deficient Radioactive Isotopes of the Rare Earth Region by Harry G Hicks. AECU-217 nd 167p

Neutron deficient radioactive isotopes of neodymium, promethium, terbium, holmium, thulium, hafnium, tantalum, and rhenium have been prepared by cyclotron bombardment employing helium ions, deuterons, protons and fast neutrons from the 60-inch cyclotron of the Crocker Radiation Laboratory of the University of California. Their radiation characteristics and half-lives have been measured. Mass allocations have been determined by chemical identification, and by cross-bombardment and yield techniques. A limited number of these have been observed as products from 200 Mev deuteron bombardments of tantalum with the 184-inch cyclotron. The production and properties of these new isotopes are summarized in tabular form.

2221 Decay of Holmium-166 by P J Grant and J M Hill Nature 163 524-525 (1949) Apr 2 (Letter to the editor)

The decay of holmium-166 has been investigated by means of a short magnetic lens β-ray spectrometer, and by coincidence and absorption measurements. The half-life was determined as 26.8 ± 0.4 hr which is in agreement with Bothe's result [Z Naturforsch 1 179 (1946)]. The momentum distribution of the β-particles and a Fermi plot of this spectrum are shown; the latter indicates that the maximum energy of the β-spectrum is 1.88 ± 0.02 Mev. In addition to the continuous β-spectrum, a single-conversion electron group was found having an energy of 70.5 ± 0.7 Kev, which has been attributed to the

RARE EATTHS AND RARE EARTH COMPOUNDS (continued)

conversion of a γ-ray of 80.2 ± 0.7 Kev in the L-shell of the daughter nucleus. A γ-radiation of 1.2 ± 0.1 Mev was also detected. The ratio of L-conversion electrons to β-particles has been estimated as about 23% while that for K-conversion electrons is probably only about 10%.

2222 Radioactive Isotopes of the Rare Earths. I. Experimental Techniques and Thulium Isotopes by Geoffrey Wilkinson and Harry G Hicks Phys Rev 75 1370-1378 (1949) May 1

This article is based on AECU-81 (UCRL-253). An abstract of the document has been listed in Nuclear Science Abstracts as abstract No. 2-1014.

2223 Thermogravimetric Analysis of Precipitates XIX. Dosage of Praseodymium XX. Dosage of Europium (Sur la thermogravimétrie des précipités analytiques XIX. Dosage du praséodyme XX Dosage de l'europium) by Thérèse Dupuis and Clément Duval Analyt Chim Acta 3 186-190 (1949) Mar (In French)

It was found with the Chevenard thermobalance that in the gravimetric determination of Pr it is necessary to heat the hydroxide above 676°, the sulfate above 413°, and the oxalate above 746°. In the gravimetric determination of Eu the oxide produced from the hydroxide can be weighed after ignition at 650°, the oxalate between 280° and 315°, and the oxide produced from this oxalate above 695°.

SCIENTIFIC RESEARCH AND LABORATORIES

2224 Design of a Shield Carrier by E C Barker. AECD-2583 Mar 6 1946 Decl Apr 29 1949 6p

The design of a lead shield carrier is described which features facility and safety in the transportation of radioactive materials.

2225 The Architectural Approach to Radiochemical Laboratory Design by A D Mackintosh. AECU-210 Apr 13 1949 35p

The subject is introduced by showing how a newly specialized field of architecture has opened which must be approached with revised concepts. General planning and layout is discussed, with thought given to various levels of radioactivity. It is pointed out that a modular system must be adhered to, in order to effect flexibility. Means to implement modular flexibility are described, as well as surface treatment, and decontaminability. Service supply, including heating and ventilating, is discussed in modular terms, as well as equipment of a permanent and semi-permanent nature. Waste disposal facilities are then touched upon: gaseous, liquid, and solid. The conclusion reached is that flexible space of a "universal" nature must be provided, as well as a standardized design for equipment to be used therein.

SPECTROSCOPY

2226 The Hyperfine Structure of Tritium by Edward B Nelson and John E Nafe Phys Rev 75 1194-1198 (1949) Apr 15

This article is based on AECD - 2350. An abstract of the document has been listed in Nuclear Science Abstracts I as abstract No. 1-1720.

TRACER APPLICATIONS - BIOLOGY

2227 The Active Ion Transport through the Isolated Frog Skin in the Light of Tracer Studies by Hans H Ussing Acta Physiol Scand 17 1-36 (1949)

Experiments using radiosodium to determine the amount of flow of sodium and chloride ions in both directions through on isolated frog skin, as a functic of a number of factors, were made. The technique used was described. The factors determining the flow were the outside salt concentration and outside and inside pH, under normal conditions. The theoretical basis for the use of tracers to determine the active transport of an ion species through a membrane was considered. The results showed that influx of Na^+ ions was much greater than the outflux, and depended on the pH of the inside solution. The

TRACER APPLICATIONS - BIOLOGY (continued)

Cl^- influx was less variable, but acted similarly to the Na^+ ions. 37 references 10 tables 11 figures

2228 Distribution Studies in Mice Following the Intravenous Injection of Diethyl β-Iodoethyl Amine Hydrochloride Prepared with Radioactive Iodine by Arnold M Seligman, Alexander M Rutenburg and Orrie M Friedman J Natl Cancer Inst 9 261-269 (1949) Feb

The distribution in the body of the nitrogen mustards, valuable therapeutic agents, was investigated through the use of diethyl β-radioiodoethyl amine (I^{131} NM) introduced intravenously in a series of mice. The preparation of the radioactive compound, the method of introduction, calculations and results are included in 7 tables and 5 figures. The conclusions indicated that most of the mustard was rapidly cyclized with the loss of the iodide ions, but some penetrated the tissues intact. The highest concentration of radioactivity occurred in the blood, lungs, and lymph nodes. 18 references

2229 Evaluation of Renal Function by Means of Radioactive Phosphorus (Bedömning av njurfunktionen med tillhjälp av radioaktiv fosfor) by L Ström Nordisk Medicin 38 1134-1135 (1948)

Following intravenous injection of radioactive phosphorus in 40 children, most of them nephritis cases, the excretion of phosphates in the urine was studied. The specific activity of the blood was found to be much lower than that of the urine and in cases of acute nephritis the excretion of both organic and ortho-phosphate was apparently greatly diminished.

2230 Incorporation of C^{14} of Glycine into Protein and Lipide Fractions of Homogenates by Theodore Winnick, Elbert A Peterson and David M Greenberg Arch Biochem 21 235-237 (1949) Mar (Letter to the editor)

Work on the incubation of C^{14} labeled glycine with rat liver homogenate indicates part of the incorporated C^{14} is associated with lipide, probably phosphatidyl serine. The results of experiments to permit critical examination of both lipide-free protein and lipide (alcohol-ether) extracts are itemized.

2231 The Penetration of Some Electrolytes and Non-Electrolytes into the Aqueous Humour and Vitreous Body of the Cat by H Davson, W S Duke-Elder, D M Maurice, E J Ross and A M Woodin J Physiology 108 203-217 (1949) Mar 15

The penetration rates of various substances into the vitreous body and aqueous humor were determined by the use of radioactive tracers (Na^{24} and K^{42}). The general technique was similar to that described earlier [J Physiology 107 141 (1948)]. However, in the case of K^{42}, a drip-infusion method was used to prevent rapid loss of the ion from the blood. Determinations of the tracers were made with the pipet-type counter described by Maurice [J Physiology 107 26 (1948)] in combination with a Dynatron-type 200 power unit, and a Type 200 scale-of-ten scaler preceded by a modified Neher-Pickering circuit. The relative penetration and concentration data on K^{42} and Na^{24} are contained in 7 tables. These results indicate that the barriers separating intra-ocular fluids from the blood plasma are not simple pore structures.

2232 Radioactive Iodine—Its Use in Studying Certain Functions of Normal and Neoplastic Thyroid Tissues by Rulon W Rawson, Bengt N Skanske, L D Marinelli and Rex G Fluharty Cancer 2 279-292 (1949) Mar

Tracer techniques with radioactive iodine in the study of the functional capacity of benign and malignant thyroid tumors are described. The relative concentrating capacities of the tumorous tissue and the surrounding normal tissue are listed in 9 tables. Dosage levels with I^{131} ranged from 100 to 2000 mc in 23 benign tumor and 21 cancer cases. The results of previous investigations with dosages of 0.7 to 28 mc [Hertz and Roberts, J Amer Med Assoc 131 81 (1946)] and 14 to 72 mc [Chapman and Evans, J Amer Med Assoc 131 86 (1946)] over 12 hr isotopes given to patients with Graves' disease are noted. The inhibitory action of thiouracil on normal hyperplastic thyroid tissue is described. The conclusions are that the natural avidity of the normal or hyperplastic thyroid for iodine is greatly inhibited by thiouracil, but that of functioning cancers is not affected. Benign and malignant tumors differed from normal tissue in the avidity for iodine, the benign type showing less avidity than normal and the malignant form little or none.

TRACER APPLICATIONS - BIOLOGY (continued)

2233 Radio-iodine in Thyrotoxicosis Lancet 256 528-529 (1949) Mar 26 (Editorial)

Some of the applications of radio-iodine in the study of the thyroid gland are reviewed. The uses of this tracer in investigating the histology and physiology of the thyroid gland in both the normal and diseased states are described with particular reference to applications and treatment in thyrotoxicosis. A few of the advantages and drawbacks of the therapeutic use of radio-iodine are briefly noted. 6 references

2234 Some Aspects of the Action of Sulfonamides I. Binding of S^{35} Labeled Sulfanilamide by Escherichia coli by Irving M Klotz and Jacklyn B Melchior Arch Biochem 21 35-39 (1949) Mar

Investigations concerning the uptake of sulfanilamide by bacteria and involving the use of radioactive sulfur (S^{35}), are described. The synthesis of labeled sulfanilamide can be performed by first labeling N-acetylsulfanilyl chloride through the method of Söll and Stutzer [Berichte der Deutschen Chemischen Gesellschaft 42 4532 (1909)] and then reacting it with the appropriate amine. This synthesis gives a yield of 31% pure product and is readily adapted to other sulfonamides. Results of experiments on Escherichia coli indicate less than 0.2% of the sulfanilamide is taken up and held within the cells, and less than 5% is attached to the cell surface.

2235 Study of Fertilizer Uptake using Radiophosphorus III by J W T Spinks, H G Dion, M Reade, and J E Dehm Scientific Agriculture 28 309-314 (1948)

The uptake of fertilizer phosphorus and of soil phosphorus by wheat plants has been measured using radioactive phosphorus, P^{32}; the wheat plants were fertilized at the rates of 0, 25, 75 and 225 lb of $NH_4H_2PO_4$ per acre. The following results were obtained: (1) with increasing rate of phosphorus application, the amount of fertilizer used increased while the percentage of fertilizer used decreased; and (2) the uptake of soil phosphorus was depressed by phosphate fertilizer application, the amount of the depression being a function of the amount of phosphate applied.

2236 The Transformation in the Rat of Carboxyl-labeled Acetate, Methyl-Labeled Acetate, and Labeled Bicarbonate into Amino Acids by David M Greenberg and Theodore Winnick Arch Biochem 21 166-176 (1949) Mar

Carboxyl-labeled acetate, methyl-labeled acetate, and labeled bicarbonate were traced, through their C^{14} atoms, for their relative rates of incorporation into the proteins of various organs of the rat, and their modes of transformation into certain amino acids. The $CH_3C^{14}OOH$ was synthesized by the method of Dauben, Reid, and Yankwich [Analyt Chem 19 828 (1947)] and $C^{14}H_3COOH$ by that of Tolbert [JBiol Chem 173 205 (1948)]. Radioactive bicarbonate was prepared by decomposing $BaC^{14}O_3$ with $HClO_4$ and collecting the evolved $C^{14}O_2$ in NaOH. The radioactive substances were injected in several portions over a 48-hr period into three 160 g male rats, and their livers and intestines were assayed shortly thereafter. The C^{14} of the two labeled acetates was incorporated to about the same extent into the proteins of various organs of the rat, the bicarbonate C^{14} content being considerably lower. The experimental data upheld the theory that acetate enters the tricarboxylic acid cycle by condensation with oxalacetate. 13 references

2237 Urinary Excretion of Radioactive Sulfur by Paul György Conf on Liver Injury. Trans 7th Conf 15-19 (1948)

The detection of S^{35} compounds in the urine by a "paperogram" method is described. The paperogram for rats which were fed methionine shows an S^{35} peak in the inorganic sulfate fraction. It was found that oral administration of radioactive methionine followed by injection of C_6H_6 gave a peak in the ethereal sulfate fraction. The ethereal peak was small and the inorganic sulfate peak was absent when C_6H_5OH and methionine were administered simultaneously and the oral administration of C_6H_5Br resulted in 2 peaks which were attributed to inorganic sulfate and mercaptic acid. From these preliminary experiments it is concluded that this method may be useful in the investigation of the metabolism of methionine in the urine.

TRACER APPLICATIONS - BIOLOGY (continued)

2238 Use of Radioactive Tracers in Biological Research by F A Paneth Nature 163 388-390 (1949) Mar 12

The history of the application of radioactive tracers in biological research is reviewed. It is noted that in selecting a tracer for a particular experiment, the factors which must be considered include the following: (1) length of half-life (i.e. should be comparable with the duration of the experiment planned), (2) harmful biological side-effects produced by the tracer, (3) choice of the compound which carries the labelled atom. The method of analysis by isotope dilution is discussed in some detail. A few of the outstanding biological tracer applications are cited and it is noted that any carbon participating in the life-cycle is naturally labelled.

TRANSURANIC ELEMENTS

2239 Solubilities of Plutonium Trichloracetate in Various Reagents by W C Beard Jr. AECD-2586 Jan 3 1947 Decl Apr 29 1949 3p For publication in NNES

The solubility behavior of plutonium trichloracetate in the following reagents is briefly described: acetone, chloroform, carbon tetrachloride, petroleum ether, sulfuric acid, acetic acid, trichloroacetic acid, hydrochloric acid, nitric acid, and a nitric acid-hydrogen peroxide mixture.

URANIUM AND URANIUM COMPOUNDS

2240 Quantitative Analysis of UO_2-U_3O_8 Mixtures by X-Ray Diffraction by F N Bensey and A C Eckert. AECD-2581 Mar 8 1949 Decl May 5 1949 11p Proposed for publication in Analyt Chem.

A method of quantitative analysis using x-ray diffraction has been applied to the determination of UO_2 in UO_2 - U_3O_8 mixtures containing 1% to 30% UO_2 by weight. Two techniques have been employed in the analysis. In one the pattern is recorded photographically, and in the other the diffracted x-rays are measured by a Geiger counter spectrometer. The photographic method is good to a lower concentration limit of 2%, and the Geiger counter spectrometer has a lower limit of 1%.

2241 Production of 6.8d U^{237} at the St. Louis Cyclotron by E L Brady, A M Jaffey, A Turkevich and H Finston. AECD-2587 1946 Decl May 13 1949 3p For publication in NNES

The yield of 6.8d U^{237} in U irradiated with neutrons at the St. Louis cyclotron has been determined in two sets of experiments, and compared with pile production at Clinton. The results are tabulated below.

Washington University Cyclotron	Yield of U^{237} (expressed as per cent of number of fissions)	Fission Rate (fission/min/gU/μ amp.)
Be target	17	3.8×10^7
Be target	1.2	
Li target	17	2.4×10^6

2242 Further Studies of the Radiation Characteristics of U^{237} by D W Engelkemeir and A Turkevich. AECD-2588 1946 Decl May 13 1949 33p For publication in NNES

Studies of the nuclear radiations of U^{237} by absorption in Al, Cu, and Pb, together with coincidence measurements give proof of the presence of many conversion electrons accompanying the decay of this nuclear species. There appear to be 50, 200, and ~400 Kev γ's besides neptunium x-rays (~ 14 and ~ 95 Kev) and particles of at least three types. No simple decay scheme seems consistent with the data on the relative intensities.

URANIUM AND URANIUM COMPOUNDS (continued)

2243 Determination of Uranium 234 by Alpha Counting by C A Kienberger. AECU-209 Mar 14 1949 13p

An alpha counting method for the determination of the weight per cent of uranium 234 in uranium compounds is described. This method consists of measuring the uranium 235 enrichment, determining the alpha activity, calculating that portion of the alpha activity which is due to the uranium 234 content, and dividing this activity by the specific activity of uranium 234. At the 95 per cent probability level, this method gives an estimated precision of ± 1.7 per cent. The accuracy of the method is estimated to be ± 1 per cent.

2244 On the Reversibility of the Reaction $3UO_3 \rightleftharpoons U_3O_8 + O$ (Sur la réversibilité de lá reaction $3UO_3 \rightleftharpoons U_3O_3 + O$) by André Boullé and Marthe Dominé-Berges Compt Rend 228 72-74 (1949) Jan 3 (In French)

In the authors' previous work [Compt Rend 227 1365 (1948)] the formation of a solid solution $UO_{2.90}$, stable at 520-610°C, was recognized as an intermediate stage in the decomposition of UO_3. In the present paper the conditions of the reverse reaction are described, viz, of the reoxidation of U_3O_8 and of the solid solution. The X-ray spectra of U_3O_8 revealed the existance of two crystalline states, I and II, the state I being obtained from the state II by heating at ≤ 575°C. Whereas a total reoxidation of II can be made through heating in air or in oxygen at 300-500°, I does not reoxidize. The reoxidation of the solid solution $UO_{2,90}$ could not be observed in the experimental conditions used for the other oxides.

2245 Polarographic Determination of Uranium (Polarografisk bestämming av uran) by Sigvard Hellestam Svensk Kem Tid 60 253-267 (1948) Dec (In Swedish)

Strubl [Collection of Czech Chemical Communications 10 466 (1938)] has given a method for a polarographic determination of uranium in the presence of iron. The present author shows that this method cannot be extended to cases when, besides Fe, other metals are present (Al, Mg, Ti, V, W, Mo). Instead, another method is suggested for the elimination of these elements through electrolysis with a Hg cathode, after a partial separation by means of a solution of cupferron in chloroform; this method is rapid, and it has the advantage of permitting the use of sulfuric acid solutions. In another procedure uranium is isolated as a perchlorate; the determination is then made by the polarographic or some other physical method. From the measurements made, the following values of diffusion coefficients of uranyl ions were calculated: in 2M hydroxylamin-hydrochloride — 0.45 x 10^{-5} cm^2/sec; in saturated potassium sulfate solution — 0.78 x 10^{-5} cm^2/sec; in 0.04-0.14M perchlorate solution — 0.73 x 10^{-5} cm^2/sec.

2246 Preliminary Report Number MSN.2 on the Examination of the Spectrum of Uranium Metal for Hyperfine Structure by S Tolansky. BR-375 Dec 7 1943 3p

The U metal spectrum was excited in a hollow cathode and examined for hyperfine structure with a silvered Fabry-Perot interferometer. The experimental difficulties encountered are briefly surveyed. Hyperfine structure due to an odd isotope was found in one line.

VACUUM SYSTEMS

2247 Scientific Foundations of Vacuum Technique by Saul Dushman. New York, John Wiley 1949 882p

This reference work on vacuum techniques discusses the following topics in detail: 1) the theory of gases, 2) vacuum pumps and gauges, 3) adsorption and getters, 4) solubility of gases in metals, and 5) diffusion of gas through metals. Extensive indexes and bibliographies are given.